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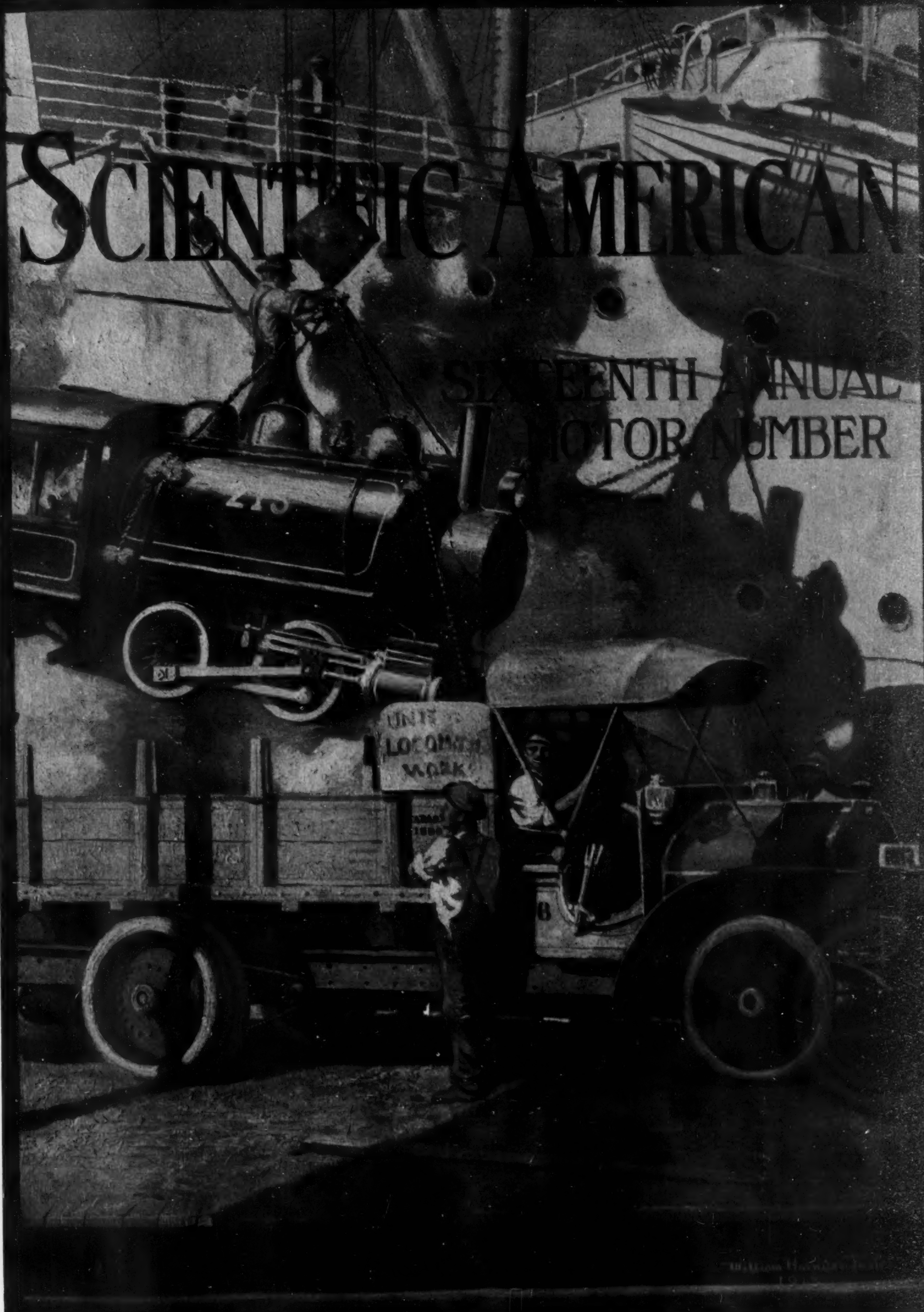

Vol. CX. No. 1
January 3, 1914

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New York, N. Y.

Price 15 Cents
$3.00 A Year

Velie

Truck Buying Narrows Down to Four Rival Makers!

Fierce Competition for Supremacy!

Competition in truck selling is now practically limited to four famous makes. That is, among the experienced buyers.

The aggregate resources of these four makers is over $25,000,000. Their yearly output is high up in the millions. Their supremacy is assured. Their guarantees are safe.

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The three-ton Trucks built by these four famous makers are the best basis for comparative specifications. And because each of these four manufacturers is building the best truck he can, the difference in specifications is not great.

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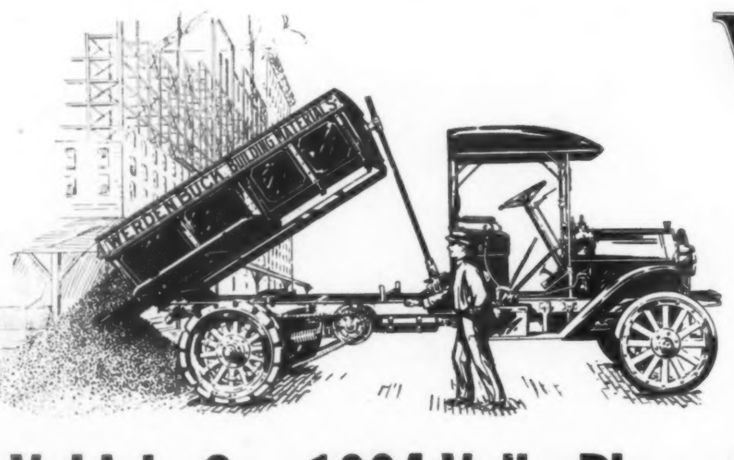
Everywhere—as a result of competitive tests between the four greatest American Trucks, the records of which any Velie dealer can show—the Velie Truck is being used by the great corporations, who buy Trucks by the dozen.

Velie



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Studebaker
"SIX"
ELECTRICALLY STARTED
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At a price lower than the price of any other "Six" in the world.
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This is not an artist's exaggerated conception of the Studebaker "SIX," but a faithful photographic reproduction of the car itself.
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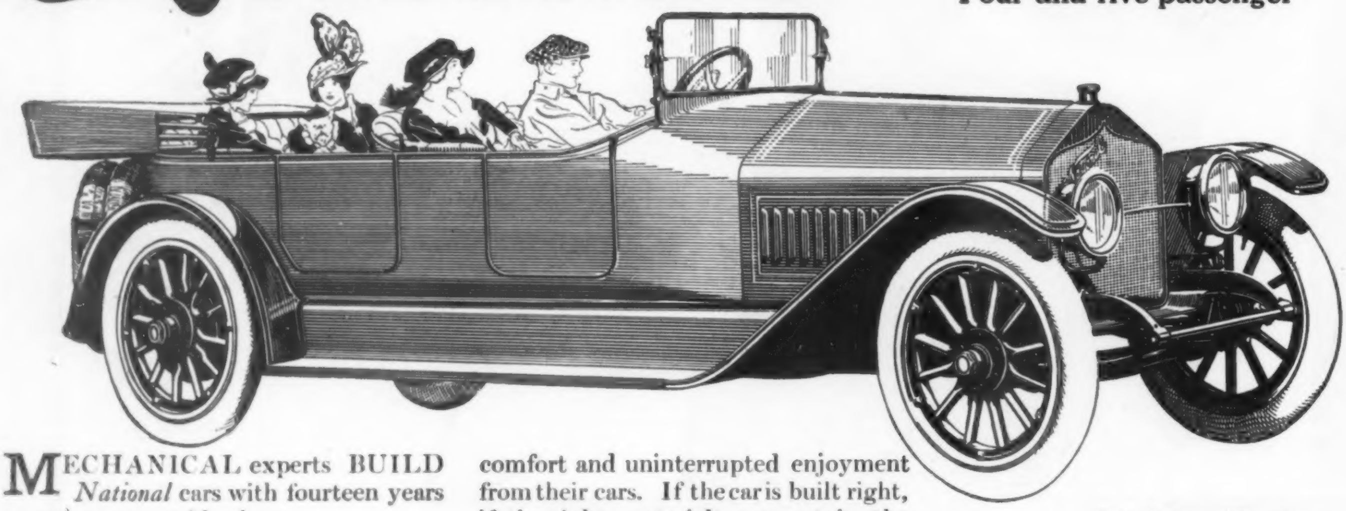

MECHANICAL experts BUILD *National* cars with fourteen years experience to guide them.

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You can't find a better built car than the *National* if you use a microscope. We give you all you can possibly demand in a high-grade motor car, and give it to you with complete abandon of worry about what is under the hood or beneath the seat.

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Motor, 6-cylinder, $3\frac{3}{4}$x$5\frac{1}{2}$-inch, cast en bloc. Tire pump, integral part of motor. Clutch, self-contained aluminum cone. Starting and lighting, electric two-unit system. Transmission, sliding gear selective type, three speeds forward, one reverse. Gauge, 56 inches. Oiling, crank-case constant level, force feed, with gear-driven pump. Ignition, high tension, dual magneto with storage battery. Tires, 36x$4\frac{1}{2}$. Firestone demountable rims. Air-pressure gasoline feed, generated by small pump in crank-case. Capacity, 23 gallons. Automatic carburetor. Two sets of brakes on 16-inch rear wheel drums. Bevel gear drive through straight line shaft with universal joints and torsion member. Full-floating rear axle. Left-side drive. Access all four wide doors. Single lever in center controls all speeds. Half elliptic springs, front; special *National* construction, rear.

Equipment:—Top complete with side curtains and boot, ventilating rain vision windshield, extra Firestone rim, electric lighting and starting systems, 12-inch double bulb electric headlights, electric license tail light, Warner speedometer, electric horn, tools and jack.

"You don't have to raise the hood"

NATIONAL owners have learned that we build *whole* cars—the name *National* is their guarantee. Every *National* car is built as a *unit*—every mechanical part operates harmoniously to produce satisfactory *results*. You leave the responsibility for its mechanical construction to our experience—forget that there are gears and mechanical parts in the car. Just rest in comfort and enjoy your ride with absolute confidence in your car.

You can buy over telephone

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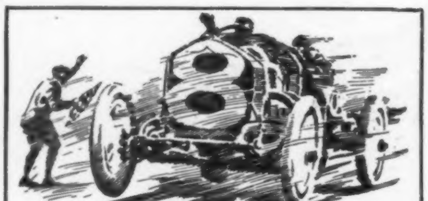
THIS new *National* embodies all our internationally recognized principles of superiority. Beautiful, economical, efficient and lavish in comfort — this car is the climax of the *National's* success in car building since its pioneer beginning. It marks a most coveted improvement in motor car designing. It is the one car that harmonizes from end to end—a symmetrical creation that is distinctive and essentially practical.



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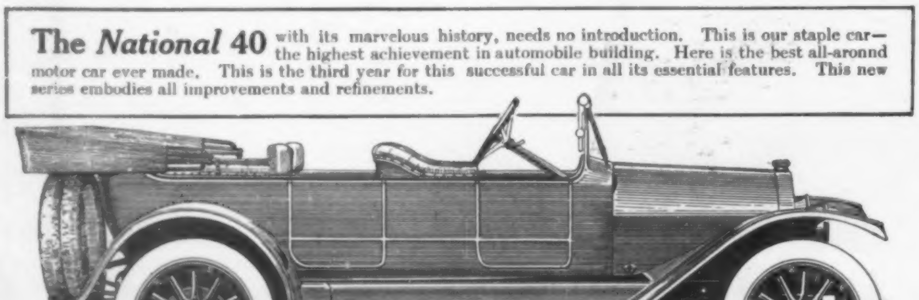

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Products of Long Experience

This company has been building popular priced sixes longer than any other concern in this country. Hence the sixes we offer are the product of many years of experience and in no sense experiments.

The *Mitchell Little Six*, which was known as the "Baby Six" in 1912, is, in our opinion, the most logical investment in the automobile market. It is not only the sensible compromise between big and little power and passenger capacity, but it has everything that any high-priced car can offer you.

It has quality that insures long life. It has the style of beauty that the exacting mind demands. It has as much speed and power as any person can desire. It will hold its place in any company and look classy and work perfectly for several years to come. Its equipment is complete, and details thereof sterling in character. The price, $1,895, brings this smart car to you ready for instant use. There is nothing left for you to buy—no extras—no appurtenances.

The *Mitchell Big Six* is the largest and best car at the price that has ever been produced. It is built along the same lines as the Little Six, save that it has 144-inch wheel base, somewhat larger tires, greater passenger capacity. Yet the quality of the two are identical. The equipment is precisely the same—the outward beauty similar. For a big family car the Big Six has no equal in America and there is nothing as good for less than $3,500 or $4,000. The price of the Mitchell Big Six is only $2,350.

The *Mitchell Four* is intended for those who feel that they cannot afford either of the Sixes. It is the only four-cylinder car we make. We build it to meet the demand of those persons who still like a four-cylinder car of class at a popular price. It has the same equipment as the other two cars and sells for $1,595. We want you to look this car over minutely and then ask yourself if there is a four-cylinder car at anywhere near the price that can compare with this one in any detail.

Here is the Equipment for all the Mitchell Models Which is Included in the List Prices, as Given:

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Specifications of the Three Great Mitchell Models:

MITCHELL LITTLE SIX—Fifty horse-power—132-inch wheel base—36x4½-in. tires—two or five passenger capacity **$1,895**

MITCHELL BIG SIX—Sixty horse-power—144-inch wheel base—37x5-in. tires—seven passenger capacity - - - **$2,350**

MITCHELL FOUR—Forty horse-power—120-inch wheel base—4 cylinders—36x4½ in. tires—2 or 5 passenger capacity **$1,595**

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SEVENTIETH YEAR

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THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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Edmund Beecher Wilson

The New President of the American Association for the Advancement of Science

By Marcus Benjamin, Ph.D.

IT is now eight years since the American Association for the Advancement of Science turned its steps southward for its annual meeting. Then it met in New Orleans under the presidency of Calvin M. Woodward, eminent for his educational work in the technical department of Washington University in St. Louis. This year it meets in Atlanta with Edmund B. Wilson, who holds the Da Costa chair of zoology in Columbia University, as its presiding officer.

Edmund Beecher Wilson is the son of Judge Isaac G. Wilson and Caroline Clark Wilson, and was born in Geneva, Ill., on October 19th, 1856.

After the usual preliminary schooling he was prepared for college and studied for a year each at Antioch and Chicago; then entering Yale he was graduated at the Sheffield Scientific School in 1878 with the degree of Ph.B. A country boy, he early developed a fondness for nature, the study of which has been the dominant influence of his life. Choosing biology therefore as the subject to which he determined to devote his career, he went to the Johns Hopkins, where under the influence of such inspiring teachers as Newell Martin and Brooks he spent three years, taking the degree of Ph.D. in 1882. A year abroad followed, during which he studied in the laboratories in Cambridge, and Leipzig, and also at the Naples Zoological Station under the famous Dorhn.

On his return to the United States he entered on his vocation as a teacher and lectured on biology at Williams College during 1883-'4 and at the Massachusetts Institute of Technology during 1884-'5. He then accepted an invitation to Bryn Mawr College, where he filled the chair of biology. In 1891 he was called to Columbia as adjunct professor of biology, and three years later was advanced to the full possession of the chair of invertebrate zoology, created for him, which he then held until 1897, when he was transferred to the Da Costa chair of zoology. He also served as member of the University Council at Columbia during 1901-03, and as dean of the faculty of pure science for the years 1905-06.

Wilson's primary interests have always been in the field of embryology and his original investigations which were begun at Johns Hopkins University have been connected chiefly with the study of animals as living things. At first his researches were concentrated on germ cells and directed attention to the study of the laws of normal development from the standpoint of the cell. These he followed with valuable contributions to problems of mosaic development, prelocalization, and differentiation in the egg. Returning more recently to the mechanism of the cell, his researches on the structure of protoplasm, on the history of centrosome, aster and karokinetic figures, and on the chromosomes with special reference to questions of heredity and sex, have occupied his attention.

His many papers, which according to competent authority have had "a wonderfully stimulating effect on biological research throughout the world," have been carefully worked up into harmonious relations with the modern aspects of the fundamental problems of biology, and were given to the world in 1896 in book form with the title "The Cell in Development and Inheritance," which his colleague, Prof. Gary N. Calkins, refers to as "one of the most widely read of modern technical scientific works."

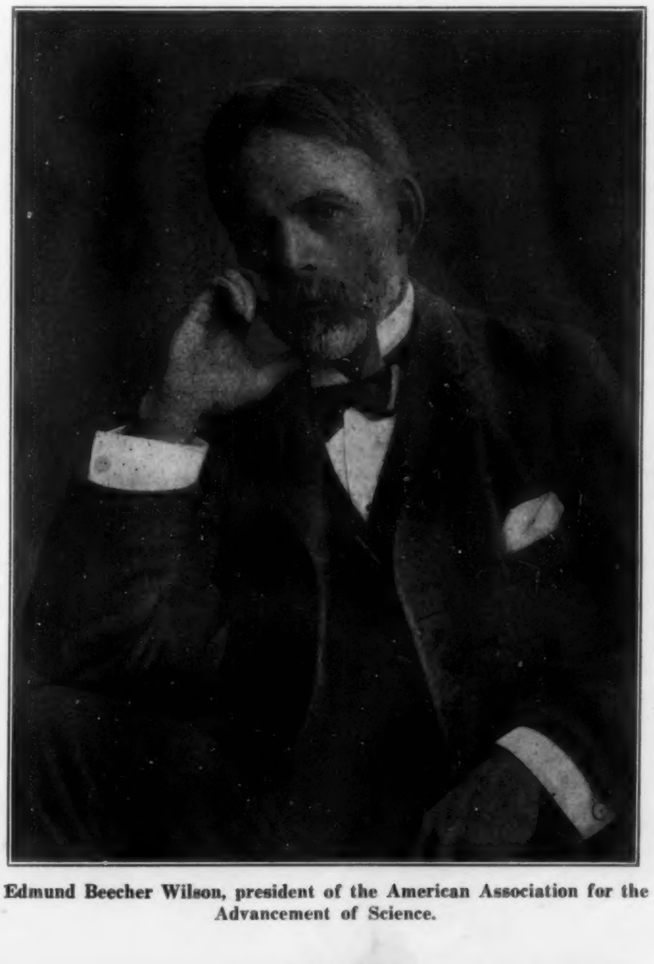
In addition to the foregoing he is the author of addresses and of various minor works in zoology, embryology, and cellular biology. His contributions in book form include (with William T. Sedgwick) "General Biology" (1887); and an "Atlas of Karyokinesis and Fertilization" (1895).

His brilliant researches early gained recognition for him and academic honors have been gladly conferred on him. In this country the three universities at which he studied, Chicago (1901), Yale (1901), and Johns Hopkins (1902) have given him the degree of LL.D., while abroad he has received the degree of Sc.D. from Cambridge (1909) and that of M.D. from Leipzig (1909).

In addition to membership in the American Society of Naturalists, the American Society of Zoologists and the Society of Experimental Biology and Medicine, he is an officer of the New York Academy of Science, a fellow of the American Academy of Arts and Sciences, and since 1899 a member of the National Academy of Science. He holds honorary membership abroad in the academies of science in Holland, Belgium, Bavaria, and Rome (del Lincei) and also of the Linnean and Royal Microscopical societies.

His connection with the American Association began with his election to membership at the second New York meeting in 1900, at the close of which he was advanced to the grade of Fellow. He affiliated with the section on Zoology, becoming its presiding officer in 1907, when he delivered an address on "Recent Researches on the Determination and Heredity of Sex."

In its selection for a presiding officer for the Atlanta meeting the American Association for the Advancement of Science is indeed most fortunate. Seldom has a more ideal choice been made, for Wilson by right follows in succession to that splendid group of men who from Agassiz and Dana to Cope and Jordan, have been the glory of American science.



Edmund Beecher Wilson, president of the American Association for the Advancement of Science.

Prolonging the Life of Steel

EXHAUSTIVE research experiments have lately been carried out to try if possible to lengthen the life of iron and steel. These experiments consist in the addition of some other metal or chemical element to the iron during the smelting to form an alloy; such elements for example as copper, silver, lead, manganese, silicon, arsenic, aluminium, nickel and tin being added. The more common method of preserving steel structures has consisted in the application of a protective coating of paint or galvan to the steel, the coating acting as an excluder of air and water, and by this means preventing the rusting of the iron indefinitely.

It is remarkable that the addition of certain elements to iron makes the resulting alloy rust and decay more quickly than pure iron. Silicon is a good example of this kind of reaction; if three pounds of silicon be alloyed with nine hundred and ninety-seven pounds of iron, the alloy will rust twenty per cent more rapidly than the pure iron.

The general results of alloying steel with the other metal show that copper and nickel are the best metals to add to the steel to give increased durability. Nickel is prohibitive on account of its price for general commercial uses.

Copper added in small quantities greatly prolongs the life of iron. Very small quantities are needed to effect this result. If to one thousand pounds of iron, two pounds of copper be added, the resulting alloy will dissolve away in acid only one tenth as fast as pure iron does. And in the atmosphere the corrosion will be only one third as rapid. An increase in the copper up to seven per cent of the alloy does not increase the power of the iron to resist corrosion. Two tenths of one per cent of copper will yield as good an alloy for resisting rust and corrosion as does seven per cent, and the resulting alloy is less expensive on account of the small amount of copper required.

The durability of this alloy has been demonstrated by some very beautiful experiments, performed in Pittsburgh, Pennsylvania, by Mr. D. M. Buck, and by Prof. C. E. Burgess and J. Aston of Wisconsin University.

Mr. Buck's experiments were carried out in a practical way by erecting sample roofs made of pure iron and others made of the alloy containing two tenths of one per cent of copper. These sample roofs were distributed both in the city in the region of the coke ovens and in the rural districts around Pittsburgh, and the rate of corrosion was noted carefully and the time recorded. The copper alloy roofs were in good condition when the pure iron had completely corroded and had fallen away. The results show also that the metals are less attacked in the rural districts than in the city. This is to be expected and is no doubt due to the carbon and acid fumes present in the city atmosphere.

The experiments carried out at the University of Wisconsin were not carried out on so large a scale as Mr. Buck's, but they confirm very clearly his results. Their experiments show that the addition of many metals, such as silver, which in themselves are too expensive for general use, have the same effect as small quantities of copper in prolonging the life of steel.

Their results also show that no very reliable data can be obtained by the accelerated acid test which will indicate the possible length of life for the steel under ordinary weather conditions.

An Echo of the Hubbard Expedition to Labrador

DILLON WALLACE, whose book "The Lure of the Labrador Wild" is a record of the adventures of himself and Leonidas Hubbard, Jr., during their exploration of the interior of Labrador in 1903, in which Hubbard died from starvation and exhaustion and the author narrowly escaped the same fate, has just returned from a second hazardous journey to the same region. The purpose of this trp was no less sentimental than that carried out in 1905 by Mr. Hubbard's widow, who, besides continuing her husband's explorations, proved to the world the feasibility of his projected route. Wallace revisited the headwaters of the Susan River, discovered during the original expedition, in order to erect a bronze tablet at the place where Hubbard died. Unluckily the tablet was lost from his canoe *en route*, and Wallace accordingly carved his comrade's epitaph on a rock.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Retrospect of the Year 1913

Civil Engineering.

A RETROSPECTIVE view of the field of civil engineering, especially if it be taken from the American standpoint, brings to mind, at once, the Panama Canal—the greatest civil engineering work of all time. In the annals of the canal the year 1913 will be memorable as having witnessed its practical completion. During the first nine months of the year Gatun Lake was filling with water; on October 10th President Wilson threw an electric switch and blew up the Gamboa Dike admitting the water to the Culebra cut; and a few weeks previously a dike at Miraflores was blown up, admitting the Pacific waters to Miraflores locks. A heavy force of hydraulic dredges has cut through the Culebra slides and is now engaged in clearing up the canal prism at the cut. On September 26th a Government tugboat made the first passage of Gatun Locks. Subsequently, whole fleets of dredges and their accessories made the passage both of the Gatun and the Miraflores and Pedro Miguel locks. Early in 1914 the canal will be in such shape that, if it were desired, the largest ship in the world could be sent through from ocean to ocean. The formal opening will take place in January, 1915, when a vast international fleet, headed by the old battleship "Oregon," will make the transit from ocean to ocean. It was a great feat to build any kind of a canal at Panama—to build a canal of this magnitude and complete the job, in spite of 30,000,000 yards of unlooked for excavation, due to slides, etc., one year ahead of the specified time, is a magnificent performance. The past year has been one of great progress on the New York State Barge Canal, and it looks as though within about two years' time it will be possible for 1,000-ton barges to pass between the Great Lakes and the Atlantic, by way of the Hudson River. A most important waterway and a competitor of the State Barge Canal is the St. Lawrence Ship Channel, between Montreal and Quebec, a distance of two hundred and twenty miles. Here the Canadian government is rushing work upon a 35-foot channel. A depth of thirty feet has already been obtained over this distance. The Cape Cod Canal, 25 feet deep, 150 feet wide and 13 miles long from Buzzards Bay to Bonstable Bay, will be opened in June, 1914. This waterway will render available for 25,000,000 tons of shipping annually a safe inside route, as against the dangers of the outside route through Vineyard Haven Sound and around Cape Cod. The vast scheme for bringing the Catskill Mountain water to New York has made great progress during the year. The Ashokan dam has been completed; the greater part of the 92-mile acqueduct is built, the water being now available for discharge into Croton Lake, and excellent progress has been made upon the deep distributing tunnel beneath New York, which, in places, reaches a depth of over 750 feet. The New York system of dual subways, another vast engineering work, has been pushed so vigorously during the year that two or three of the main sections will soon be in operation or within measurable distance of opening. This work will practically treble the existing facilities, and the probabilities are that, within three or four years' time, a greater part of the system will be in active operation. After six years of labor, the enlargement of the Assuan dam on the Nile, Egypt, has been finished. The dam, which is 1.21 miles in length, has been raised 16.6 feet in height and increased in thickness by about sixteen feet, and thereby the volume of water stored has been increased from 35,300,000,000 to over 81,000,000,000 cubic feet. The benefits conferred upon Egypt by irrigation are to be repeated beyond the Red Sea in Mesopotamia, where the engineer who is mainly responsible for the Egyptian improvements is now developing and constructing a system of irrigation which promises to restore to that storied land much of its one time fruitfulness and prosperity. The great works of irrigation being carried by the United States Government in the West and the Middle West have, one by one, been completed, and when some adjustment of the rates and time of payment have been made, there is no question that the full predicted benefits of this great work will be realized. Next to the Panama Canal, the engineering work which has attracted greatest attention in this country during the year has been that of the control of the Mississippi River. The devastating floods have merely served to prove that the regulation of this river can be secured only when the whole co-ordinated scheme of revetment and levees, as planned by our army engineers, has been completed. If the staff and the large working plant at Panama were removed to the Mississippi Valley and the whole job placed under one-man control, and the necessary funds made available, the problem of the Mississippi Valley would be easy of solution.

Naval and Military.

The opening of the year 1914 finds the United States in the humiliating position of a third-rate naval power—third rate in so far as the strength of its first fighting line is concerned. This is due to two things. First, the revolution in naval rating which has been brought about by the advent of the "dreadnought," and second, the disposition of congressmen to play politics with naval policies and cut down national in favor of local appropriations. There is one first-rate power—Great Britain with forty-two dreadnoughts built and building; there is one second rate power—Germany, with twenty-six such ships built and building; there are three third rate powers—the United States, France, and Japan, respectively, with 12, 11 and 10 dreadnoughts built and building. If we rank third-class in material there is some consolation in knowing that we rank absolutely first-class in the high quality of the officers and men of our navy. Moreover, such dreadnoughts as we possess are fully the equal, ton for ton of displacement, of any ships in the world. With the exception of the British navy, which has more than doubled the accuracy of its fire by the introduction of the fire-director system of Sir Percy Scott, our shooting is believed to be as good as that of the other leading navies. Let us take such comfort from this belief as we may—the disquieting fact remains that in ships of the line we are third-rate, and in shortage of torpedoes at the very bottom of the list! There has been a steady increase in the size of ships and the guns they carry. Great Britain has gone up to 28,000 tons, Germany to 26,000 tons, and we have two ships on hand, the "Pennsylvania" and her sister, which are of from 31,000 to 32,000 tons displacement. The multiple-gun turret finds increasing favor. The United States is placing the three-gun turret on the "Nevada" and "Pennsylvania" classes. Italy has already put in commission her first three-gun turret ship, the "Dante Alighieri." Russia and Austria are using the same turret; but England, Germany, and Japan are holding back; apparently, they still believe that two guns in a single turret is the maximum number that can be used to full efficiency. France, on the other hand, is building several dreadnoughts which mount twelve guns in three four-gun turrets; and the French, by the way, are exceedingly clever and successful in their designs of ordnance. The multiple-gun turret greatly assists the spotter; simplifies fire control; and secures a very considerable reduction in weights. Certainly the most remarkable ships of the year are the five British battleships of the "Queen Elizabeth" class, whose contract speed is to be 25 knots, and their armament eight 15-inch guns. The builders of the turbines assure us that they look for 27 knots in these ships. Meanwhile our own navy sticks to 21 knots as a maximum speed. Which is right? Time alone can tell. England, Germany, and Japan are still building battle-cruisers with speeds of 28 to 30 knots. Japan will soon have four of these ships, carrying among them thirty-two 14-inch guns, afloat on the Pacific. In the event of war they will constitute a knotty problem for our Board of Naval Strategy at Washington. An interesting development has been the launching by Great Britain of a "destroyer of destroyers," as she was called by the First Lord, a ship of 3,500 tons and 30 knots speed. On the other hand, the Germans have built for Russia a destroyer, the "Novik," which made 37 knots on trial, and 36.2 knots for six hours of that trial—and so it goes. Altogether, the year 1913 must be considered as finding the naval-diplomatic situation as regards this country in a critical condition; with its navy sunk to the third-rate rank, at a time when the administration is adopting a policy with regard to neighboring States, which, for audacity and grave portent, has never been equaled in the history of the country.

The Merchant Marine.

Judged from the standpoint of construction, the two outstanding features of the past year are, the continuous increase in the size of ocean steamships and the great amount of thought, labor, and expense, which have been devoted to finding the best type of motive power. Last year was notable in the annals of the merchant marine as witnessing the advent of the first 900-foot ship, the "Imperator" which is 909 feet in length, 98 feet in beam, and displaces, at maximum draught, some 58,000 tons. The present indications are that the big ships of the future of her class will be of moderate speed, say 23 knots, this being the assigned speed of the new "Aquitania," 901 feet in length, which will enter this port during the summer of this year, flying the Cunard flag. The year witnessed the launch of the "Vaterland," sister to the "Imperator," 940 feet in length, and the laying down of another ship of similar dimensions. The application of the Diesel engine to marine propulsion has made steady strides during the year. The "Hagen," propelled by Diesel engines of 2,300 horse-power, made a very successful maiden voyage to this port, and later there came the "Wotan," a large tank steamer 404 feet in length, and capable of carrying 7,680 tons of oil, which is driven by Carels-Diesel engine of 2,900 horse-power (steam engine rating). The builders of this engine have such confidence in its reliability that they have put the whole of the power into a single engine driving a single propeller. During a recent test before marine engineers and representatives of the technical press in this city, this big unit, the largest Diesel marine engine yet built, was run at maximum revolutions with a remarkable absence of vibration, and the reversing from full speed ahead to full speed astern was done in eight to ten seconds, a truly wonderful performance. Rivaling the Diesel engine in its interest is the marine transformer or transmitter, designed in its various forms to reconcile the high speed demands of the turbine with the low speed demands of the propeller, if both are to secure their highest efficiency. In this country, the Westinghouse helicoidal mechanical gear has shown an efficiency of something over 98 per cent, and it has been fitted on the collier "Neptune" of 19,300 tons displacement. In addition to the steam economy due to the use of high-speed turbines, its introduction would secure a great saving in weight, both in the engine and the boiler plant. These are the economies aimed at in all transmission gears. The "Jupiter," sister to the "Neptune," has been fitted with an electrical reduction gear, consisting of a generator delivering current to motors on the propeller shafts. This ship is now undergoing trial. Parsons, in England, has fitted mechanical reduction gears to several cross channel steamers and large economies have been secured. The German Foettinger gear was submitted to a 14-day test at the Vulcan Works, at loads of from five thousand to ten thousand horse-power, during which an efficiency of 90 per cent was secured; and this gear is being installed on several large German steamships. There was completed for the Great Lakes service in November of this year at Wallsend-on-Tyne, England, the "Tynemount," a freighter of 2,400 tons capacity, which has a most interesting drive, consisting of two six-cylinder Diesel engines direct connected to three-phase generators, which furnish electric power for an induction motor mounted directly on the propeller shaft. This is the first large commercial ship to carry an electric reduction drive, and its performance will be watched with keen interest. The "Titanic" disaster has resulted in the formation of an international committee which is now sitting in London to determine the question of interior safety construction for ships, the number and character of lifeboats they shall carry, and the various protective devices, in the way of wireless telegraphy and other apparatus, designed to protect the life of the passenger at sea. There is no question that the whole subject will be most thoroughly and conscientiously thrashed out at this conference, and an entire revision and improvement of existing rules will be secured.

Electrical Engineering.

Although its inception was prior to 1913, the active work of the recently organized Society of Electrical Development falls within the past year, and marks one of its most important outgrowths. The object of this society is to introduce electricity more widely, and to infuse a new spirit of co-operation in the business of selling electricity and electrical goods. Probably the most promising electrical event of the year is the development of the nitrogen lamp. This is a tungsten lamp filled with nitrogen gas, in which the filament may be heated to a much higher temperature. In the large units of 4,000 candle-power and over it shows an efficiency of 0.4 to 0.5 watt per candle-power. Smaller units using 10 amperes at 4 or 5 volts give an efficiency of 0.6 to 1, or even 1.25 watts per candle. Lamps for the standard 110-volt circuit will produce a thousand

candle-power and over at 0.5 watts per candle. It is found difficult to produce nitrogen lamps in smaller units owing to the cooling effect of convection currents in the gas. The lamp produces a light that is closer to daylight than any other except the Moore tube filled with carbon dioxide. Other developments in lighting are the Cadmium lamp, which is similar to the mercury vapor lamp, except that cadmium is used instead, to produce a light similar to daylight, and the so-called "cold" light for stereopticon and kinetoscope work. It consists of a series of tungsten lamps which are successively lighted with current at supervoltage, giving flashes of intensely white light that come with such frequency as to give one the impression of a continuous light. Thus, while the heat effect of the electric current is dissipated over a great area, the luminous rays are concentrated in a very small point of space. The use of electricity on the farm for light and power is steadily increasing. Much has been done with intensive culture, not only under the direct influence of electricity, but indirectly by the use of electric pumps for irrigating purposes. In England experiments have been made to determine the influence of high frequency currents upon the growth of chickens, and the results are truly astonishing. Chickens living in the electrified zone in five weeks reached the weight of normal chickens of three months. Because it is a young branch of electrical engineering, there is a great deal to be said annually about the progress of wireless telegraphy. Early in the year communication was established for the first time directly between Germany and the United States. Several new stations have been built or are building for transatlantic wireless service. During the fall wireless telegraphy gave us another demonstration of its importance to navigation, when the "Volturno," afire and fearing immediate destruction in a storm, summoned a rescue fleet by wireless telegraphy, which arrived in time to save a large part of the crew and passengers. To aid the mariner in finding his way across the ocean, wireless signals are sent out daily from the Eiffel Tower in France and from the Arlington station in this country. Wireless telegraphy is being used on trains to permit of communication with stations along the line. Wireless or induction train signal systems are being tried out on some lines. Considerable progress has also been shown in wireless telephony. Spoken messages were sent 600 miles from Rome to Tripoli. At this late date it seems remarkable that material progress should have been made in telegraph and cable systems. During the year a system has been devised which permits of sending the regular dot and dash signals over cable lines and relaying them automatically over land lines. Railroad electrification also shows material progress. For instance, the Chicago, Milwaukee and Puget Sound Line is electrifying 450 miles of its main line between Harlowtown, Montana, and Avery, Idaho. The Norfolk and Western Railroad is electrifying the Bluefield Vivian section, 85 miles long, over which sixty-five thousand tons of coal are handled daily. The Pennsylvania Railroad has announced that it will extend its electrified zone from New York to Elizabeth, and this is probably but a step toward electrification all the way from New York to Philadelphia. Recently a commission appointed by the city of Melbourne, Australia, to determine the best system for its suburban railways, covering about 300 hundred miles of steam and railroad tracks, reported that the direct current system showed a material advantage over single-phase alternating in first cost and also in the annual cost of operation.

Astronomy.

By far the most important astronomical announcement of the year came from Prof. George E. Hale, director of the Mount Wilson Solar Observatory. It will be remembered that some years ago Prof. Hale discovered the Zeemann effect in sun spots, thereby conclusively proving that sun spots must rotate and establishing a field of magnetic influence on the sun. Even more important was the later discovery to which we refer which is nothing more or less than the fact that the entire sun may be regarded as a rapidly rotating magnet.

It has long been known that the conspicuous star cluster in the Pleiades is accompanied by faint nebulosities. Until the work of Mr. Slipher at the Lowell Observatory, nothing was known of the real nature of these faint clouds of light. Very long exposures revealed to Mr. Slipher a distinct spectrum quite different in character from that of any previously known nebula. He showed that the brighter parts of the nebulosity of the Pleiades shine with light which is exactly similar in spectroscopic character to that of the brighter stars of the cluster. It is supposed accordingly that the nebulosity in the Pleiades consists of opaque matter, perhaps of meteorites or fine dust which accompanies the stars of the cluster and shines by their reflected light.

On the night of August 13th, 1911, the third satellite of Jupiter, Ganymede, passed directly in front of a star of the seventh magnitude in the constellation Virgo, and for observers in the southern part of the earth, actually hid the star for more than four minutes. The circumstances of this remarkable occultation were carefully calculated in advance by Banacialewicz. It appeared that the best observing stations would be in South America. Dr. Ristenpart, a German astronomer of distinction, set about the organization of observers throughout Chile. Ganymede is much smaller than the earth, and its shadow is only a little more than four thousand miles in diameter. As Jupiter and its satellite moved, this "shadow" crossed the earth, its center, passing over the southern extremity of South America, a little north of the Straits of Magellan, while its northern limit reached barely to the boundary between Chile and Peru. By comparison of the duration of the occultation as seen from different places, it was possible to obtain very accurate information regarding the size and shape of the eclipsing body. On the basis of the many visual observations made under Dr. Ristenpart's direction, it seems necessary to assume that the satellite like Jupiter itself is flattened at the poles; for otherwise the calculated length of the occultation at the northernmost station, where the star appeared to pass just inside the satellite's disk, should have been much longer than the observed time, Dr. Ristenpart concluded that the equatorial diameter of the satellite is four thousand seven hundred miles and the polar diameter four thousand three hundred miles, so that it is a little more flattened in proportion to its size than Jupiter itself.

Comets are no longer the astronomical curiosities they once were. Three or four are discovered with the aid of the telescope or the camera every year, and 1913 proved no exception. The principal comets were those of Schaumasse, discovered on May 7th at Nice; Metcalf, discovered on September 1st; Neujmin, discovered on September 5th; Delavan, discovered on September 26th and recognized as a return of Westphal's comet of 1852; Tinner, discovered on October 23rd and identified as a return of the third comet of 1900; Delavan, mentioned on another page.

Steam Railroads.

So far as America is concerned, development in steam railroads during the past year have been strictly along those lines which during the past two or three decades have been strongly characteristic of American railroad practice. To-day, we are carrying freight, not only at a much lower rate per ton per mile than any railroad in the world, but even at a lower rate than similar freight is carried for the same distance on the cheap waterway transportation systems of Germany. This result is largely due to our greatly increasing the size of the individual train unit. Locomotives have grown to be several hundred tons in weight; fifty tons has become the standard freight car capacity, and cars of seventy-five and even one hundred tons are in the making or are seriously proposed. The matter of better rails is still a burning question, to which both the railroads and the manufacturers are giving closer attention than they are perhaps to any other product in the heavy manufactured steel trade. The future promise of the railroads getting absolutely reliable rails that will stand up under winter and spring service, lies in the new electric steel making process, which the United States Steel Corporation is trying out on an extensive scale, as explained and illustrated in our issue of June 7th, 1913. The advantage of the electric over the Bessemer and basic Open-Hearth processes are that it secures a more complete removal of oxygen; an absence of oxides; an absence of segregation; the practically total elimination of sulphur and phosphorous—with the result that a very reliable rail is secured. In this connection, it should be noted that, during the year, there has been a wonderful growth of the "Safety First" movement, the importance of which has come to be thoroughly appreciated, not merely by the management, but by the employees. The disastrous wrecks on the New Haven Railroad, to which we gave so critical attention in 1912, were followed by other wrecks in such quick succession, as to convince the nation at large and Congress in particular, that legislation was necessary. The Interstate Commerce Commission is being given the necessary legal status to enable it, not merely to advise, but enforce its recommendations—a wise provision if the delegated authority be exercised with discretion. The automatic stop, thanks largely to the New Haven disasters, has been thrust into the prominence which it merits, and many of the keenest minds, both expert and lay, are being devoted to the production of a stop which shall be thoroughly practicable. That it is the finest safety device ever devised for the protection of railway travelers is proved by the record of the Interborough Railroad where, during several years of operation on express trains, under a headway of one minute and forty-three seconds, there has been only one failure out of 277,846 movements. In locomotive construction, the noticeable developments have been the increased use of superheaters and the tendency to regard the simple, superheated locomotive as the best all-round machine for future use. Great interest was aroused by the production of the first Diesel-engine locomotive, a powerful engine, built for express service, containing a driving engine coupled to the driving axles, and an auxiliary engine working independently of these. The trials are now being carried out, and we understand that the engine has fulfilled all expectations as to its hauling ability. It is too early, however, to make any definite statement as to the permanent usefulness of this type. With the increasing size of the locomotive has come a corresponding demand for mechanical stoking, the work of feeding the fuel to the huge modern boilers being more than one man can accomplish. Several types are being tried and in some cases good results have been secured. Undoubtedly mechanical stoking has come to stay.

Aviation.

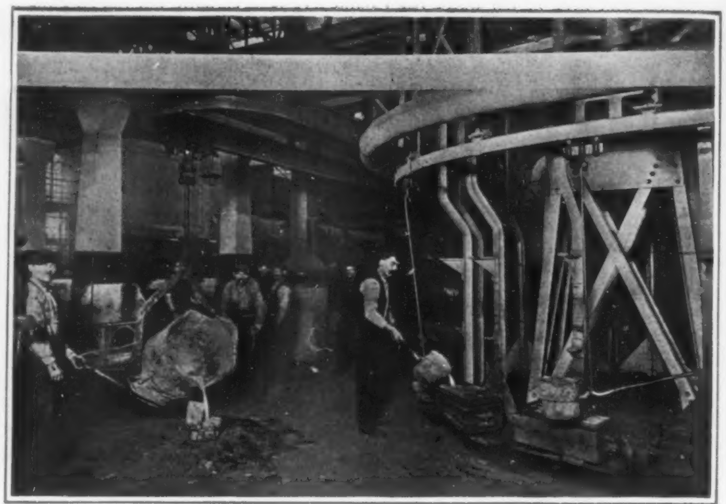
A broad view of the field of aviation during the past twelve months reveals two most important directions in which more than any others, notable progress has been made. These are endurance and stability. Particularly in cross-country flying have both the aeroplane and the dirigible established their endurance and reliability. Witness the feat of Brindejonc des Moulinais, who, in exceedingly stormy weather, flew from Paris to Warsaw in 10 hours and 12 minutes, with but two stops, at an average speed of 91.47 miles an hour. Or consider the feat of Stoeffler who, flying to and fro across Germany, as though the whole Empire were but an aerodrome, covered in 24 hours a distance of 1,350 miles at an average speed of 56 miles an hour. Then turn to the Riviera and see Garros taking wing over the Mediterranean for the coast of Africa, with such supreme confidence in his motor that he stripped the pontoons from his hydro-aeroplane, and, with the machine as thus lightened, covered 550 miles or more in a continuous flight of nearly eight hours, landing safely on the African coast. For records of speed we look naturally to the Gordon Bennett cup annual contest. Last year the French won it at an average speed of 105.5 miles an hour. This year it was won in France by a Deperdussin, torpedo-body, monoplane, whose 160 horse-power Gnôme motor drove the machine around the course at an average speed of 124.77 miles an hour. Far surpassing this, however, was the feat of the Frenchman, Gilbert, who, on the last day of October, won the Pommery cup by flying from Paris to Puertniz, Pomerania, a distance of 650 miles, at an average speed of slightly over 124 miles an hour. The height record was won by Perreyon in a 160 horse-power Blériot, who rose above the earth to a height of 19,685 feet, or about three and three fourths miles. Von Blaschke carried two passengers with him to a height of 11,740 feet. Passenger-carrying aeroplanes of large capacity are becoming common. The record for size is held by the Sikorsky biplane, which, with 1,358 square feet of surface and 400 horse-power, flew for over an hour with seven passengers and for fifteen minutes with twelve passengers. America gave to aviation the first power-propelled man-carrying aeroplane. It contributed also through Curtiss the first practical hydro-aeroplane; and it looks as though to the many triumphs of the flying boat will be added the crowning feat of making the first crossing of the Atlantic. A $50,000 prize awaits this accomplishment; and it is possible that the present year will see the inauguration of transatlantic aeroplane flight. In spite of many disasters which would have discouraged a less persistent and courageous people, the Germans seem to have unabated confidence in the rigid dirigible. The shocking fatalities, twenty-eight in number, which resulted from the total destruction, through explosion, of Germany's latest and finest dirigible, "L. II," have been definitely ascribed to an error which may be easily corrected in future construction. The many disasters are largely offset by the brilliant successes of the dirigible. The largest of these had sufficient capacity to cross the Atlantic, and the maximum speed was between 55 and 60 miles an hour. The record of the past year shows that both the aeroplane and the dirigible are destined to find their greatest immediate field of usefulness as an arm both of the military and the naval service, the former for swift reconnaissance for limited periods of time and the latter for more extended observations lasting for many consecutive hours. The sensational feats of Pégoud and others have shown that the aeroplane possesses far greater stability if properly handled than was supposed. To this is to be added the fact that the gyroscope and the swinging pendulum weight have both been utilized successfully for giving to the aeroplane satisfactory automatic stability.

Miscellaneous.

Of the incidents of general interest in the field of science which have taken place within the past year, probably none has attracted such universal attention and feeling as the publication of the history and fate of the Scott Antarctic expedition. We have in due season paid our homage to the heroes who thus perished in the pursuit of science. In the field of anthropology intense discussion has been aroused by the discovery of the Piltdown skull and the divergent con-

(Concluded on page 23.)


A string of ladles run from the cupolas to the molds.


The molds travel in endless procession to the pouring point.

Going Through the Shops—I

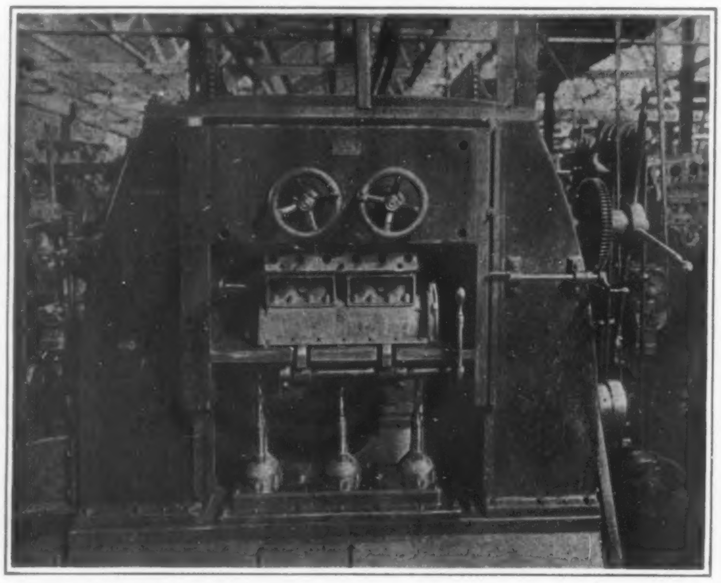
The Scientific American's Associate Editor Sees How a Factory Turns Out a Thousand Cars a Day

By A. Russell Bond

YOU may pay five thousand dollars for an automobile or only half a thousand, and, in either case, if your choice has been wise, you will get your full money's worth. Which is to say that widely differing species are classified under the generic term "automobile." The species range from the cars of luxury, models of beauty and power, smooth, quiet running machines, possessed of every latest wrinkle of convenience and whim of design that fashion may dictate, all the way down the list to the humble members at the other extreme, not works of art but of utility, staunch machines, small, but amply powerful for all ordinary purposes and possessed of an amount of "go" that is really astonishing when we consider their exceedingly low cost.

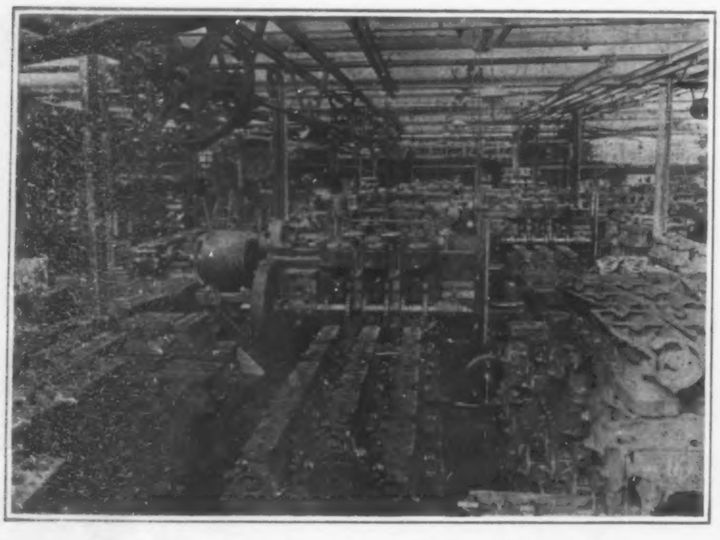
Manifestly, we cannot discuss the manufacture of machines so divergent in one and the same article and, therefore, we shall defer to a later installment the exceedingly interesting processes employed in the building of the more refined product, and take up now the equally interesting story of how the low-priced car is manufactured. Curiously enough, the production of the latter car involves the greater outlay of capital and ingenuity. However, the outlay is manifest not in the machine, but in the plant that builds it. If a motor car is to sell at a low figure, it must necessarily be made in large quantities. Engineers must resort to every mechanical kink and contrivance that will simplify the work and save precious moments.

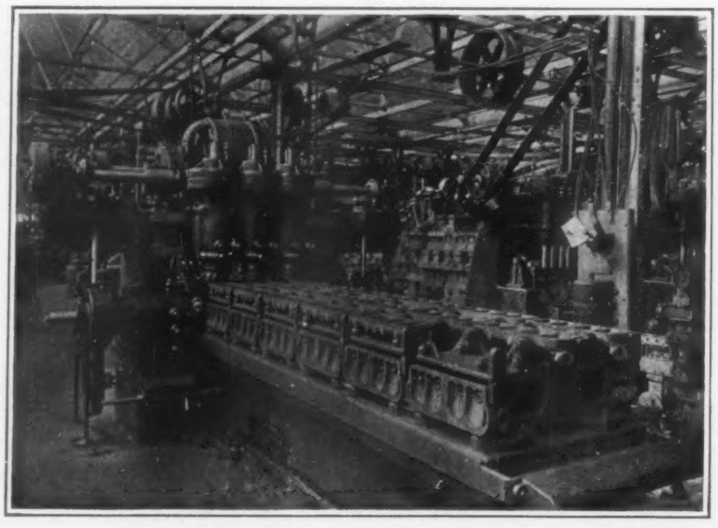
The accompanying photographs will serve to illustrate how system has been carried to an extreme in the manufacture of the small automobile. The pictures were taken in a factory which, during the busy season, turns out a thousand automobiles per day. From the foundry to the assembly department the work has been analyzed to the minutest detail with a view to economizing time. Men are given tasks that are very simple in themselves, and, by dint of repetition day in and day out, acquire a knack that may cut the time of the operation in two. A man may become a specialist in so insignificant an operation, for instance, as putting in a certain bolt in the assembling of the machine.

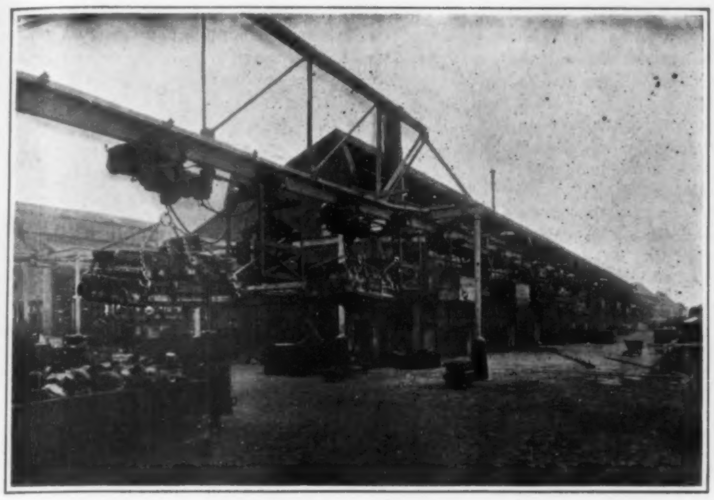

A drill inverted to save time in placing the casting.

We have space to illustrate only a few of the apparently infinite stages involved in the building of the car. Starting with the foundry we find a row of cupolas, one of which is always ready to deliver a stream of molten metal. In front of the cupolas overhead is a track of I-beams laid out in a long loop that runs by the molds. Mounted to travel on the lower flanges of the I-beams are carriers from which are suspended large ladles or "shanks" into which the metal is poured. The ladles are then moved along the track until they come to the molds. Here the molten metal is poured into small hand ladles, as required, and with them the molds are filled. In order to have a continuous supply of molds ready to receive the metal, they are mounted on a series of conveyors. Each conveyor consists of an endless chain of carriers similar to those by which the ladles are transported, and running in a loop of overhead track that lies at right angles to the track for the ladles. On the swings suspended from the carriers, the molds are placed. At one end of the loop, the molds are assembled. Thence they progress to the point where they are filled and pass on to the place where they are removed from the conveyor, and replaced by fresh molds.

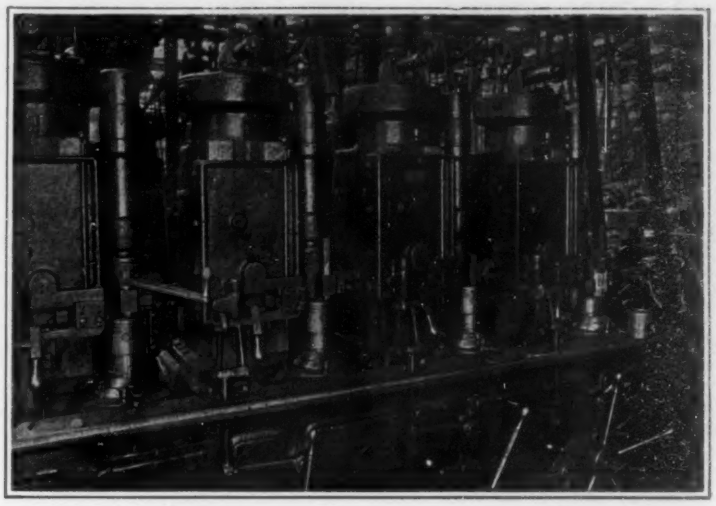
The resulting castings, after they have had a chance to season for a few days in the open, are carried into the machine shop on an overhead monorail system which is depicted herewith. Each monorail train consists of an operator's car and two hoists capable of lifting two tons each. These trains pass through the factory, constantly transporting the materials over the heads of the workmen and depositing them where required.


Machining the top and two sides of fifteen cylinder castings.


Facing thirty cylinder head castings at a time in a milling machine.



The mono-railroad that carries castings into the machine shop.



Automatic vertical gang lathe for turning down four pistons at once.

This mono-railroad comprises over a mile of track.

In the machine shop let us follow the operations on the cylinder castings as illustrative of the time-saving methods employed. Two of the photographs show how the cylinder castings and the cylinder heads are machined in gangs. Fifteen cylinder heads may be run through the milling machine at a time, having the top and two sides machined at one operation, while in the milling of the cylinder heads, thirty castings may be attached to the table of the miller at once. The castings are all assembled in jigs so that little time is consumed in securing them to the table.

The cylinders are bored out four at a time to within one thirty-second of an inch of their final dimension, after which they are reamed out true to within one one-thousandth of an inch. The cylinders are tested by placing the casting on a standard over an electric light, inserting a plug gage in the bore and noting whether any light passes between the plug and the cylinder walls.

The drilling of bolt holes and the boring of bearings call for the development of special machinery. In one case, namely, that of drilling the main bearing bolt holes in the cylinder casting, the usual operation is inverted; the casting is supported over the drills which feed upward instead of downward. The object of this is to make use of the lower face of the casting as a working base, letting it rest on the drill table, and centering the casting by means of guides which engage the two outer cylinders, thus saving time in securing the work to the machine. There are many such cases in which startling liberties have been taken with the standard machine tool merely to gain a few minutes of valuable time. For instance, there is a toggle press in which the punches move horizontally. Speaking of punch presses, they have even had the audacity to punch holes in iron castings. A malleable iron casting at the forward end of the drive shaft tube has six holes punched in it at a single operation.

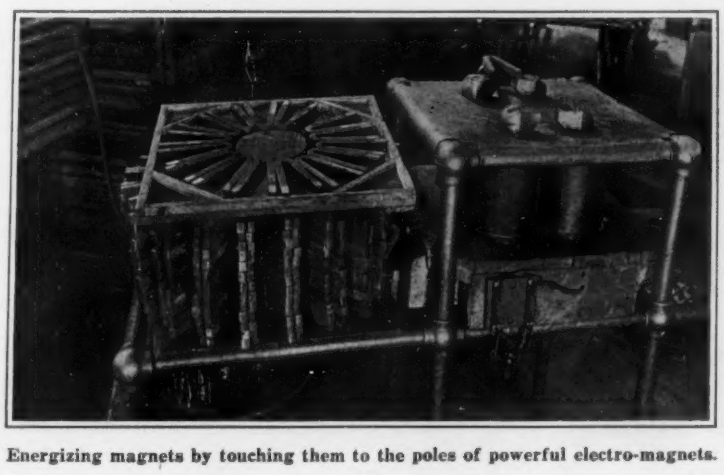
In roughing out pistons, a gang-lathe is used which permits four of the castings to be machined at once. Each lathe member completes all the operations on the piston automatically, one tool facing off the head, another chamfering the upper edge, three others cutting the ring grooves, another cutting the relief in the side of the piston, while still another tool finishes the bearing surface of the piston to within a very small fraction of an inch of its final diameter. After the piston has thus been roughed out, it is put on the lathe and a finishing cut brings it to within one one-thousandth of an inch of the specified dimension.

In order to turn out 1,000 machines a day the mechanism must be specially designed so that the individual parts may be made readily and cheaply. The crank case is stamped out of sheet steel; a gang of eight presses is required to bring the metal to proper form and it must be annealed three times during the process.

One of the interesting details in connection with this car is the manufacture of the magneto. In the particular type employed, sixteen magnets are used which are secured to the flywheel of the motor while sixteen double coils are mounted on the frame. This calls for the winding of 32,000 coils and the manufacture of 16,000 permanent magnets per day. The magnets are cut out of stock to the required size, heat treated, bent to U-shape, heat treated again and straightened. Then they are magnetized by merely touching them to the poles of powerful electro-magnets. After they have been magnetized, they are assembled in trays, as shown in one of the photographs, with the north pole of one magnet touching the south pole of the next adjacent magnet, and so on. The field coils are wound in gangs of eight, insulated copper ribbon being the conductor employed. The winding operation is very simple and, as eight coils are produced at a time, it is possible with three or four hand machines to furnish all the coils required.

A gang of powerful presses that form the crank case.

Testing the gears of a differential for noise.



Energizing magnets by touching them to the poles of powerful electro-magnets.

The rear axle of the machine is rather interesting. It consists of two tubes, each of which is flared at one end in a bulldozer and fitted over a bell to which it is welded in an electric welder. Two of these axle sections are put together, the bells forming the housing for the differential. The gears are tested by placing them on an arbor connected with an index needle and turning them in mesh with a master-gear, when the slightest eccentricity will be shown greatly magnified by the needle. Before the rear axle may be assembled in the chassis it is put through a test which consists in running the drive shaft with an electric motor in order to work in the gears. If they make too much noise they are simply discarded and go to the scrap heap. Similarly the motor of the car is tested by running it for a time until its bearings have been eased up.

In the machine shop there are so many machines going at once, such an infinite variety of work being performed, that one emerges from it in a daze. In the assembly department, however, the operations are more readily comprehended, and one is fascinated at the miraculous growth of the machine there before his eyes. An assembled rear axle is laid over a pair of horses, the side frames are added, the front axle applied, the wheels mounted, then it moves on to where the engine is fitted in place; another advance and the dashboard and steering gear are bolted fast; at the next step the radiator is affixed; then the gasoline tank is mounted on the chassis and filled with fuel, and almost before we realize it the completed chassis has reached the end of the line.

It is difficult to start a new engine before all the parts have worked themselves into their bearings, and so the machines are not cranked, but are started by pressing one of the rear wheels against a pair of rapidly revolving pulley wheels in the floor. At the same time, a rubber hose is connected to the exhaust pipe of the engine, so that as soon as the motor does start up, the gases will be carried through the hose to the outside of the building. The chug of the motor is heard. A lever is thrown. Off starts the chassis through the doorway, wrenching itself loose from the exhaust hose. In an instant it has disappeared around the corner in a cloud of smoke. The trial spin ended, it re-

turns to another point in the plant where a car body comes down an inclined chute from an upper floor and is rapidly clamped to the chassis by specialists in this particular line of work. And lo, a new automobile has been born. But congratulations must be short-lived because another is on the way and due to arrive within less than a minute.

The Car of 1914

As we gaze backward over the stretch of years that commenced with the birth of the automobile, one thing stands out clearly among the mighty improvements that have been made. The six-cylinder car is predominant. From a small beginning, it has swept on until in 1914 it has well-nigh carried all before it. It is the prevailing feature of the past automobile year beside which other features pale—but not into insignificance.

The year gone by has seen an unprecedented number of prominent automobile manufacturers proclaim their adherence to "Sixes Exclusively." Others, who, up to the opening of the 1914 season, have looked at the six-cylinder car askance, have been compelled to take it up in self defense. If we delve into figures, it is revealed that the number of makers who produce six-cylinder cars exclusively has increased from an inconspicuous three per cent of a total of twenty-eight well-known makers in 1908 to 34 per cent of forty-two makers in 1914. The figures illuminating the decline of the four-cylinder model are even more impressive. Sixty-four per cent of twenty-eight makers produced four-cylinder cars exclusively in 1908; in 1914, but 12 per cent of forty-two makers will list only four-cylinder models. The percentage of manufacturers producing both four- and six-cylinder models shows equally startling changes. In 1908—only six years ago—one fourth of the twenty-eight makers produced both; in 1914, no less than 54 per cent of forty-two makers will produce both. It is plain that the "six" is the predominating car and that the promise of 1913 in this respect has been more than fulfilled.

It goes without saying that the car of 1914, be it "four" or "six," is a better car—better in a number of respects. But, as was the case last year, the change is largely in details.

Among the more noteworthy features is the manner in which the new season's models have been electrified. In addition to the electric starter and electric illumination we now have the electric gear-shifter and the electrically controlled two-gear drive-axle, both brand new features. That the former bids fair to remain with us is indicated by the fact that not one, but several, well known makers have adopted it, and though there are those who hold to the belief that not more than the mere selection of the gears should be done electrically, leaving the actual shifting to more mechanical means, the opinion is by no means general. The two-gear rear axle would seem to fill a need of the four-cylinder car; for it permits the engine to be operated more nearly at its maximum efficiency under all conditions, and, in a measure, insures that smoothness of action which is a characteristic of the "six" at low speeds.

Electric engine starting and lighting apparatus has advanced, too. The apparatus is lighter now than it has been in the past and therefore is more efficient. There seems to be a tendency toward the utilization of separate units rather than a combined unit for the two functions, although opinion is still largely divided as to which is the better method. At any rate, electric engine starting is now supreme. The demand for it has virtually forced every other type of starter off the market, a fact which is well exemplified by the action of several prominent manufacturers who have used pneumatic starters for years, but who have cast them out for electrical apparatus for their 1914 models. Another feature which is new to the 1914 car is the combination of side and head lamps, a palpable improvement too long deferred.

The silhouette of the 1914 car is changed. In the first place it is slightly lower, which may be expected to affect stability, and there is a marked tendency toward the adoption of the sloping or tapered engine hood so prominent a feature of foreign cars. Between the engine hood and the dash we now have a concave scuttle instead of one that is convexed in a great many cases, and this, with the general tendency toward the carrying of spare tires at the rear of the tonneau, has had a great influence in altering the silhouette of the car. With deeper scuttles has come the dash gasoline tank, which bids fair to supersede the tank hung at the rear. Here again is the silhouette changed.

It is interesting to note—and the conclusion can be drawn from an inspection of almost any of the new models—that American designers at last appear to be paying much deserved attention to the Prince Henry type of stream-line body. Slowly it is being driven home that vehicle efficiency can be increased by the simple expedient of carefully designing body curves so as to take advantage of the entering-wedge principle. Although designers have not carried the idea to the extreme exhibited abroad, the tendency is nevertheless toward a reduction of wind resistance. Body designers would do well to take a leaf out of the aeroplane builders' book in this respect.

Another feature worthy of more than passing note is the unmistakable trend toward the adoption of domed mud-guards. Two years ago not more than two or three American cars were fitted with them. Now, however, it is different. Not only do the domed mud-guards fit the wheels better—of itself a laudable attempt to enhance appearance—but they act as a surer protection than do the flat ones, and for this reason they must be hailed as a material improvement.

With mention of the general widening of seats and doors, the latter being now for the most part of the full U shape, the clearing of running boards and the almost universal adoption of windshields that are built into place and no longer can be looked upon as accessories, bodies can be dismissed. It is pertinent to add, however, that left side control has materially increased in popularity, a fairly large number of makers who last year clung to right side control, having switched over in response to the insistent demand. One maker who retains right side control has solved the problem by hinging his steering wheel so that it may be folded down out of the way of passengers entering or leaving the front compartment.

With regard to mechanical construction, the influence of the Knight type engine, which appears to be holding its own in public esteem even if it has not made a remarkable gain during the past twelve months, is more than ever apparent in the efforts which have been made to silence poppet valve mechanisms. There is scarcely a maker who does not inclose valve parts by way of muffling such slight noises as cannot be eliminated by more careful fitting and the reduction of clearances to the minimum. The growing use of the so-called silent chain for camshaft and magneto drives is generally credited with reducing the noise of operation considerably.

There is a well defined tendency to reduce the weight of reciprocating parts by way of reducing vibration, and smaller bores with correspondingly higher piston speeds are coming into greater favor; but the stroke to bore ratio gives no indication of increasing.

The year has been marked by the attempts of several makers to equip their cars to use kerosene, and in at least one case results have been so gratifying that the maker feels justified in warranting results with the heavier fuel. At the same time those who cling to gasoline have in many cases made attempts to increase engine efficiency by dash carburetor adjustments, whereby either the supply of fuel or of air or both can be readily adjusted by the driver. Dashes in general carry more equipment than they have in the past. The attempt of a year or so ago to clear away everything off the dash, leaving nothing for the operator to watch, has come to nothing, and dashes now are cluttered up to a greater extent than ever before.

In the mechanical construction of the car, no startling changes have been made. The four-speed gearset holds its own, as does the bevel gear final drive. Contrary to the general belief of a year ago, the worm drive has not made the advance that was promised for it. Instead, makers seem to prefer the perfection of the bevel drive or the adoption of something else, the ingenious combination of bevel and spiral gear that has been placed on all the cars of one maker serving as an excellent case in point. Abroad there has been developed and placed in use by one maker a double herring-bone driving gear. Nothing of the kind has as yet appeared in America.

In conclusion we would add that no review of progress would be complete without at least passing mention of the recent development of the miniature automobile which has come to be styled "cyclecar" for the want of a better name. That the present demand for these vehicles is largely an assumed one is the consensus of opinion of automobile engineers, and several of them even deny the permanency of the type, primarily because of its narrow tread and the difficulty of producing it at a price low enough to avoid skimping in construction.

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Radioactive Ores in the United States

Early in 1912, from information received by the Bureau of Mines, it became evident that large quantities of valuable material were being wasted in mining the rare-metal ores of the West. In pursuance of its endeavors to increase efficiency in the mining and treatment of mineral resources in the United States, the bureau assigned Dr. R. B. Moore, physical chemist, and K. L. Kithil, mineral technologist, to investigations covering the production of uranium and vanadium ores, the elimination of waste in mining, and the development of methods for working up valuable raw material into finished products. In the chemical side of the investigation Dr. Moore was assisted by C. F. Whittemore.

As a result of this investigation discussed in a report recently issued by the Bureau of Mines, it has been definitely shown that, although the Austrian government has conserved its own resources of uranium and radium by purchasing the Joachimsthal mines and by carefully supervising pitchblende production, the deposits of radium-bearing minerals in the United States are being rapidly depleted by wasteful exploitation, chiefly for the benefit of foreign markets.

Seemingly the country has been quite unaware of the extent to which uranium ores have been sent abroad. Investigation has developed the fact that during the year 1912 carnotite ores carrying 28.8 tons of uranium oxide were produced and that practically the entire amount was exported. The major part of this ore carried between 2 and 3 per cent U_3O_8, as it appears that no ore carrying less than 2 per cent can at present prices bear the cost of transportation. This means that 8.8 grammes of radium chloride, or an equivalent 11.43 grammes of radium bromide, will be obtained from the ore shipped from this country in 1912. Only one American company has been preparing radium salts of a high degree of radioactivity, and its product has only recently been offered for sale. The American ores exported were purchased for their radium content. It is improbable that all of the ores exported are now represented by finished product, but the 1912 production of radium from American ores can not have been much less than the quantity mentioned, for uranium was being shipped abroad in almost equal quantities in 1911, and is still being sold for future manufacture. It can probably be definitely stated that in 1912 there was obtained from American ores nearly two and one half times as much radium as from all other sources combined.

In the mining of uranium ore, for every ton marketed there are at present some five tons of low-grade material thrown on the dump and much more left in the mine awaiting only a feasible concentration process for commercial exploitation. Mr. Kithil has shown that elutriation can be applied to both uranium and vanadium ores and that a large proportion of the valuable material now going to waste can be readily obtained in marketable condition. If water is not available, air separators may be used, or other devices for dry separation. The uranium deposits of Colorado and Utah are being rapidly depleted for foreign exploitation, and it would seem to be almost a patriotic duty to develop an industry that will retain our radium.

Although no one can predict with certainty the value of radium or its possible application to science or medicine, the subject is certainly well worthy of investigation by our highest scientific authorities, and under proper technical control, it opens to American industry a profitable field for exploitation.

Although at $90 per milligramme for radium chloride the total value of the radium shipped in 1912 amounts only to $792,000 and the mining and separation of the ore can accordingly be considered only as one of our smaller industries, the fact should be noted that of this amount approximately $710,000 went into foreign hands and opened to foreign medicine and science opportunities in this most promising field that have been denied to our own people, except by repurchasing the manufactured radium compounds at an almost prohibitive price.

France, Austria, England, and Germany have their radium institutes fostered by their governments or by philanthropic foundations. Up to the present time, although the United States has been furnishing a large part of the material for these foreign investigations, comparatively little has been done in the hospitals and laboratories of this country.

A Meteorological Office in Edinburgh.—The British meteorological service, in co-operation with the Scottish Meteorological Society, is planning to establish an office in Edinburgh, analogous to the Meteorological Office in London; i. e., a center from which meteorological information will be distributed to the government authorities and the public.

Science

Ben Nevis, the highest mountain in Scotland, was for many years the site of one of the most famous meteorological observatories in the world, and the discontinuance of this institution, as a result of the withdrawal of government support, was regarded by meteorologists as a serious calamity. Now it is reported that the site of the observatory is to be occupied by a tourist hotel, connected with the base of the mountain by a railway. As, even without the railway, Ben Nevis is climbed by some 15,000 people every year, it is safe to say that the commercial undertaking will be more prosperous than was the scientific one.

Fighting Mosquitoes with Bats is advocated by Dr. Charles A. R. Campbell, who claims to have exterminated countless millions of the malaria-carrying pests by means of a "bat-roost" erected alongside a large body of foul, stagnant water near San Antonio, Texas. The roost is a tall wooden structure not unlike the belfries of which bats are proverbially fond as places of residence during the day. It is provided with a tall louvered window, giving the creatures free ingress but keeping out most of the light. Dr. Campbell finds that mosquitoes are by far the commonest food of bats. Since the roost was erected, in 1911, it is claimed that both mosquitoes and chills have become scarce in the neighborhood.

Plans for the Proposed College of Tropical Agriculture in Ceylon, mention of which has already been made in these columns, have recently made rapid progress. The college is to occupy 40 acres on the left bank of the Mahaweli River, opposite the Royal Botanic Gardens at Peradeniya, at an elevation of 1,600 feet above sea-level. The main buildings, which will cost $200,000, are to be arranged similarly to those of the Cornell College of Agriculture at Ithaca, N. Y. The lectures will provide for two groups of students; men with degrees in agriculture who wish to specialize in tropical agriculture may take a one-year course, while courses of two years or more will be given to less advanced students.

Sleeping Sickness Investigations.—By way of a postscript to the article on sleeping sickness in the SCIENTIFIC AMERICAN SUPPLEMENT of August 16th, it may be stated that Sir David Bruce, during a recent brief visit to England before resuming his work in Africa, declared that the sleeping sickness in Nyasaland is not the same as that of Uganda or of the West Coast, although it belongs to the same category. It is more rapid, and equally fatal, no cases of recovery having been recorded. According to the London *Times*, the Colonial Secretary has appointed a committee to investigate the whole subject of the spread of trypanosome infection among man and stock by tsetse flies in Africa. It is proposed to try an experiment of game destruction in a localized area, and to consider whether it is advisable to attempt the general extermination of wild animals with a view to checking these appalling diseases.

The International Institute of Agriculture now numbers 53 countries and colonies among its adherents, the latest additions to the list being Paraguay, Guatemala, the Dutch East Indies, the Union of South Africa, Tripolitania, and Cyrenaica. The fourth session of the general assembly of the Institute was held in Rome, May 6th to 12th, under the presidency of Count Francisco Guicciardini. The United States was represented by five delegates. Probably the most important subject of debate was that concerning the promulgation of an international agreement in regard to the control of plant diseases. At present many countries, including the United States, enforce plant quarantines or otherwise contribute to the common task of checking the spread of plant diseases, but many others do not. Although the assembly passed resolutions in favor of the maintenance of government phytopathological services throughout the world, an international service seems still remote. It is hoped that the French government will soon convoke an international meeting of specialists to consider this question. To meet the growing expenses of the Institute, it was decided to increase the subscriptions of the various countries; that of the United States will hereafter be $8,000 per annum. The recent publication by the Institute of the first "International Yearbook of Agricultural Statistics" is said to have greatly stimulated interest in the collection of agricultural data, on uniform lines, all over the world. In its work of abstracting the current literature of agriculture for its bulletins the Institute has been confronted with the difficulty of finding equivalents in various languages for many technical terms; accordingly the project is now under consideration of compiling a polyglot vocabulary of the principal terms employed in agriculture. The assembly passed a resolution affirming the international significance of the problem of protecting birds useful in agriculture, and suggesting its further encouragement. Other projects advocated were the collection and dissemination of information concerning seed inspection, dry farming, and commercial fertilizers.

Automobile

Leon Bollee died recently in Paris. He was considered one of those who had done most to advance France to a front rank among the nations in the motor car industry. M. Bollee's chief claim to fame, however, is his service in 1908 to Wilbur Wright. Wright found a friend in M. Bollee who placed his services at his disposal and brought about the demonstrations at Mans which convinced the French people that heavier-than-air flying machines were an actual possibility. From then on, Wright's success was assured in Europe.

Now Comes the Home Gasoline Still.—On account of the constantly increasing and almost prohibitive cost of gasoline as an automobile fuel, competition has become keen in the production of motors, carbureters, fuel savers and even low grade fuels. However, an English company has designed a small still by means of which an automobile owner may convert four gallons of crude oil into three and a half gallons of fuel in two hours. The oil is placed in the lower part of the still and heated by means of a burner underneath, this burner being operated on gas or oil. The vapor arising from the heated oil is condensed in cooling coils surrounded by cold water, and is drawn off at the side into any suitable tank or vessel.

An Unusual Type of Car Heater.—To utilize some of the heat of the waste products has been the object of quite a number of persons who have sought to increase the comforts of winter motoring; but not all of them have been successful. A new type of heater that but recently has made its appearance has a number of commendable features, first and formost of which is that it may be easily attached by almost anyone who is handy with tools in a short space of time. In its simplest aspect the heater is nothing more than a miniature radiator such as commonly is used for hot air, steam and hot water heating. Part of the exhaust gas is led from the exhaust pipe through the radiator, whence it escapes through a relief vent to the outer air. It is in the manner of admitting the heated exhaust products to the radiator, however, that much of the novelty exists. Instead of a plain valve in the exhaust pipe there is a rotor, operated by the pressure of the exhaust gas, which in turn opens a small disk valve that admits part of the products of combustion to the radiator; thus only a small part of the gases pass into the radiator, the exact amount being governed by a small lever which in turn is connected to the disk valve so that the opening may be varied. As the heating surface is large and the tubing is fairly light only a comparatively short time need elapse before the heat is felt by the occupant of the car. To attach the device it is merely necessary to section out a small piece of the exhaust pipe and substitute for it the combined rotor and valve that go with the heater. In the construction, two heaters are used, one in the front and one in the rear of the car, though only one need be used and it can be placed wherever the fancy of the owner dictates.

A Semi-solid Pneumatic Tire.—A new tire has made its appearance, which is a sort of combination of solid and pneumatic. It is not unlike the ordinary tire for which it can be substituted without alteration in existing standard tire rims. Its principal point of difference lies in its enormously thickened tread and in the unusual manner in which the tread is formed. The tread itself is four or five times as thick as the normal tread and formed in it there are a number of very deep indentations alternating on either side and overlapping slightly at the center of the tread. Between these indentations, at the sides there are other scooped out places, the purpose of which is to assist in the radiation of natural heat. By means of the deep indentations it is pointed out that the principal drawback to the solid tire, barring its lack of resiliency, of course, is eliminated. This drawback it may be explained is due to the fact that the weight of the car and its progression force a ridge, or wave, of rubber around the tire just in front of the point of contact between the tire and the road, the net result being that the tread soon loosens itself from the base and comes away. The indentations, it is claimed, do away with the travel of this wave by permitting distortion to take place and allowing for the return of the rubber to its natural form. Incidentally, their edges provide a means for the tire to bite its way through mud or water and scrape an acquaintance with the roadway itself. Consequently the tire is practically non-skidding. The thickness of the tread obviously accounts for the fact that the tire is more than ordinarily resistant to punctures and blow-outs and so confident are the makers that the tire will not only stand up in service but will stand up an unusually long time to boot that they unreservedly guarantee it for 5,000 miles, 1,500 more than the manufacturer of ordinary tires. Despite the heavier tread of the tire, which is used with the ordinary inner tube, its weight averages only about 10 per cent more than the weight of the orthodox tire.

Centrifugal Force on Automobile Tires

By C. E. Palmer

At first glance it would seem that each and every element going to make up the running gear of the modern automobile is balanced to such a nicety that any speed attainable under normal conditions would hardly be sufficient to necessitate serious consideration being given to any small, unbalanced weight. However, it has been demonstrated that even such a small weight as the tire valve is subjected to sufficient centrifugal force at high speeds, especially in racing cars, to warrant the placing of an equal weight on the opposite side of the wheel to overcome the energy developed by the rapid motion of the unbalanced valve.

The valves, including their caps, vary in weight for the different sized cars on which they are used, from $3\frac{1}{2}$ to $8\frac{1}{2}$ ounces, and these weights seem insignificant when compared with the weight of a wheel and rim. But when the wheel is revolved at several hundred revolutions per minute a considerable centrifugal force is exerted, acting at any point in its travel radially away from the center of the wheel. It is intended to show here the tremendous forces that are developed at different speeds if the valves are not counterbalanced by weights on the opposite sides of the wheels.

The velocity in feet per second of any particle of matter moving in a circular path with a constant radius, is represented by the product of the circumference and the number of revolutions per second. Now the centrifugal force of the same particle is the product of the weight and the square of the velocity, divided by the product of the radius and the force of gravity, which is 32.16 feet per second. Then substituting the value of V^2 in this second formula, we derive the equation, $C = 0.00034\ W\ R\ N^2$ pounds, where W is the weight of the body, R the radius of action, and N the revolutions per minute.

For the purpose of demonstrating by means of this formula, the necessity of balancing the wheels on high speed cars, values will be assumed to correspond as nearly as possible to actual practice. Let the distance from the center of the wheel to the center of gravity of the valve, be 15 inches; the weight of the valve and cap, $7\frac{1}{2}$ ounces or 0.468 pounds; and the diameter of the tire, 36 inches. Cars which will not attain a speed of 60 miles per hour are unusual, and it is an every day occurrence for racers to maintain a speed of 75 or 80 miles per hour throughout a long contest or trial run. As a speed that is not at all unusual, let us assume 70 miles per hour for the first example. This is equivalent to 6,160 feet per minute, and in traveling at this speed a wheel with a 36-inch tire will make 654 revolutions per minute. Substituting these values in the above equation we get:

$$C = 0.00034 \times 0.468 \times 1.25 \times 654 \times 654 = 85.1 \text{ lbs.}$$

In other words a $7\frac{1}{2}$-ounce valve on a 36-inch wheel traveling at 70 miles per hour will exert a lifting force of over 85 pounds when the valve reaches the top of the wheel. In case both valves of either pair of wheels are in the same relative position with regard to the axle, they will exert a combined lifting force of 170.2 pounds, and if they are opposite each other there will be a seesawing force acting on the car. Considering that there are four of these valves it is easily seen that they will exert forces in various and constantly changing directions as the wheels shift their relative positions in rounding turns in the road.

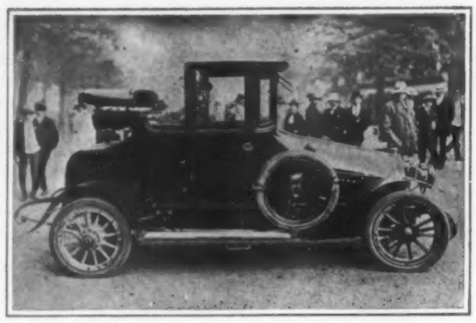
Since the centrifugal force varies as the square of the speed it requires only a slight increase in the speed to make a large increase in the force exerted. For instance, if the car travels at 75 miles per hour the force is increased to 97.5 pounds, and at 80 miles, which is frequently attained, the force on each valve will be 111.3 pounds, while at only 40 miles the force is 28 pounds. In a car going at the fastest rate of speed yet attained by man, 142 miles per hour, the force exerted by the valve is nearly 400 pounds.

Considering these almost neglected forces it is easily seen that some cognizance of them should be taken the same as is done is designing balanced wheels of stationary machinery. That racing drivers are coming to realize what these neglected forces might mean in case of an accident and loss of control of the car, is shown by the fact that a famous English driver has equipped each of his tires with two valves instead of one, the valves being placed on opposite sides of the tires in order to provide a perfect balance. It is said that the car will run at 80 miles per hour and hold the road remarkably well, where before it skidded badly at high speeds and was very difficult to control. Many American drivers also balance their valves by placing metal weights on the rim or felloes of the wheels opposite the valves.

Elk in Utah.—Elk have been found in the Uinta national forest, Utah, for the first time in many years. Since they are not from shipments from the Jackson Hole country to neighboring forests, the State and Federal officials are gratified at this apparent increase in big game as the result of protection.

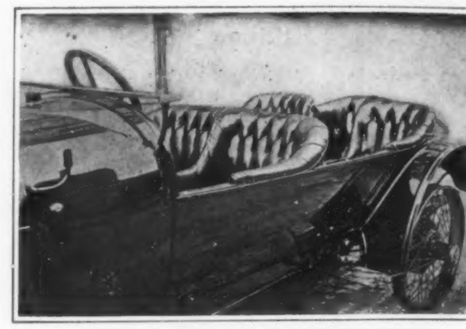
An interesting example of the "boat type" body.

The peculiar feature of the design lies in its ram-like forward lines and its torpedo stern; it is styled a skiff-torpedo and the body, though metal, is grained to represent wood. Lightness of construction evidently was sought, for running boards are missing and the mudguards are small.



Modified type of two-passenger coupé model.

When closed, this body has much the appearance of a "conning tower." It is a good example of the European practice of sloping the engine hood sharply to blend with the lines of the deep scuttle. Owing to the lowness of the chassis, the body appears somewhat squat when the back is folded up.

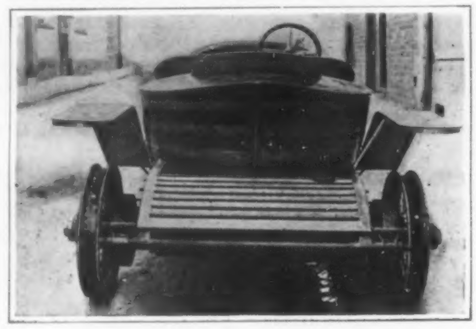


A clever solution of the seating problem.

In this body, the designer has placed the tonneau seats *en echelon* by way of giving all three occupants plenty of elbow room. The design, incidentally, provides for sociability among the passengers; conversation is facilitated; for no one is required to lean over any one else.

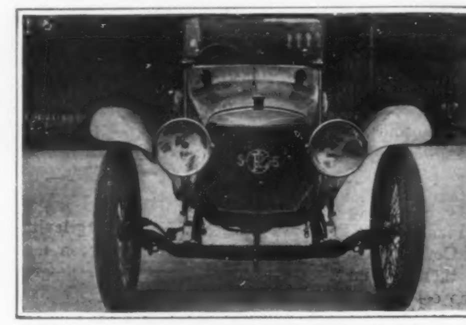
Ingenious storage spaces that satisfy a real demand.

To provide for the safe carrying of goggles, gloves and the hundred and one other motoring necessities is not always easy, though the designer of this body has not found it particularly difficult. In the average American car, storage space of the kind is unknown.



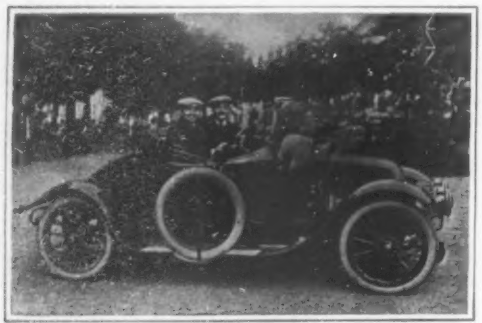
Is closer resemblance to a real boat possible?

The fidelity with which the boat builder's art has been imitated in this body is truly astonishing; the "hull" is properly built up of a number of "skins;" decks are laid in true nautical fashion and even the cockpit has a coaming. Note the protected fuel tank.



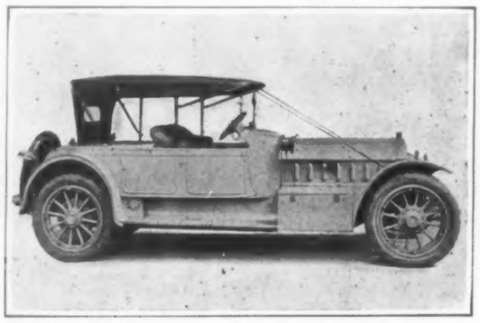
Dodging the conventional in front elevations.

The resemblance to an aeroplane with its widespread wings is unmistakable. The miniature "side" lamps, set into the dash, are in marked contrast to the powerful head lamps. The windshield, unbound at the top, reflects a well-defined tendency in design. The body is styled a skiff-torpedo.



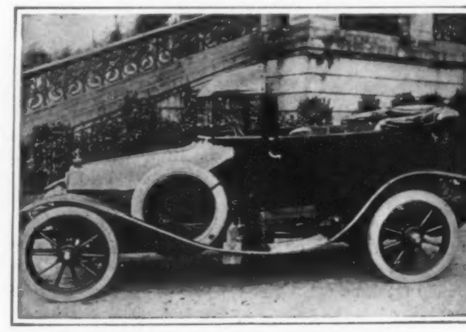
Side view of lately developed runabout model.

Compactness is the predominating feature of this vehicle which somewhat resembles a great black beetle, what with its sloping front and rear and its low-hung chassis. The provision of ventilators on the rear luggage compartment is unusual.



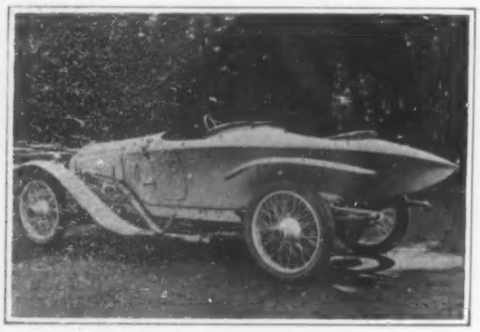
American three-passenger car that is different.

The third seat at the rear closes up out of sight and when closed is waterproof; besides it there are commodious lockers. The position of the tool box is worthy of note, for though fairly large, it does not obstruct the running board.



Clever combination of sedan and limousine.

When the top is folded back, as shown, the body is to all intents and purposes an open touring body; but when it is raised the occupants may be as snug as the proverbial bug. What a contrast between the curving fender line and the severity of American practice!

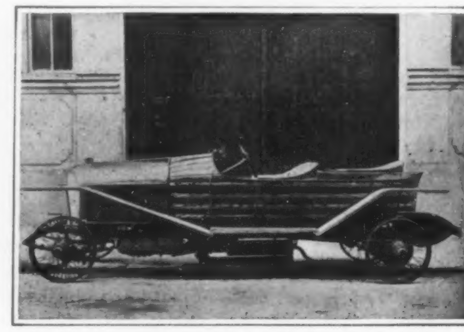


Another of the curious foreign "boat" bodies.

The exaggerated flare to the top-sides, the tiny after cockpit and the peculiar stern all proclaim the marine origin of the type. Mudguards are reduced to the minimum, it will be noted, and there are no side entrances to the single rear seat; running lamps are mounted atop the head lamps.

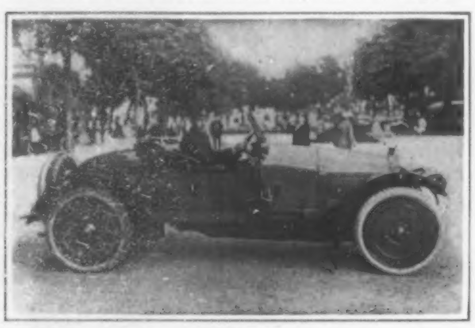
How foreign designers reduce wind resistance.

Type of racing body in which the stream-line principle is well exemplified, the theory being that the pressure at the rear nearly neutralizes the head resistance. The extreme to which the idea is carried is indicated by the rudder-like projections on the rear frame members.



Another view showing lines of the "terra marine" body.

From the side, the resemblance to a boat is even more pronounced; the lines are those of the typical, fast runabout launch. The illusion is made complete by holding a card so as to obscure the engine hood. This body caused a genuine sensation at the recent French salon.



A representative type of fast foreign runabout.

Disked wheels, practically unknown in America, serve to reduce wind resistance and to promote cleanliness; they are fairly common abroad where little attention is paid to convention in the matter of appearance. Note the "turtle-back" rear effect and the lowness of the chassis.

The exaggerated coupé type of town vehicle.

The apparent great length of the chassis is accounted for by the fact that more than half the space is taken up by engine and driver. The abrupt, unfinished appearance of the inclosed part offsets the elaborate attempt at line blending at the front.

Brand new arrangement of seats and storage space.

It will be noted that the forward seats are staggered for the laudable purpose of providing both occupants with plenty of room, and half the tonneau is reserved for luggage. The body is a utilitarian one, though the passenger capacity is somewhat limited.

NEW IDEAS IN CAR BODIES DEVELOPED CHIEFLY ABROAD

The Adaptability of the Motor Truck

Installations That Fail Because the Trucks Are Not Worked to Their Full Capacity

By W. A. McDermid

As a piece of labor-saving machinery, with a very wide range of designs and sizes, it is obvious that the motor truck should be selected with a view to its exact fitness for the character of the work. This is, in fact, so obvious that too much emphasis has been placed upon it, and it has been made the prime consideration in the operation of motor vehicles, with the result that through the neglect of other and more important factors, the truck has had to bear the blame for failures to produce the economies of operation of which it is really capable.

The evidence which demonstrates the advantages of motor truck transportation is so overwhelming that it is difficult to understand why there should be in many cases a serious question as to the real value of the truck. Yet far-seeing truck makers, their salesmen, and thoughtful business men who are considering this investment are frankly facing this situation and seeking to determine the reasons back of this condition in the motor truck industry.

It is apparent to them that there are hundreds of very successful motor installations where a large economy in dollars and cents is clearly traceable. There are many others in which a premium—an additional cost—is gladly being paid because of certain superior facilities or services which the motor truck affords, and which are considered worth the price and therefore a profitable investment. And there is a third class, in which the cost of operation has been so prohibitively high, as to render the purchase of trucks an apparently mistaken investment.

Part of this last situation has been due, no doubt, to the over-enthusiasm of the truck salesman, who, in perhaps an excusable zeal for his product, has led the prospect to expect the impossible, or has failed to analyze the customer's needs, or, having analyzed them, has not been sufficiently frank to admit the inadequacy of his particular make for the purpose.

While the manufacturers themselves realize this tendency and for the most part combat it vigorously, this is not, however, by any means the root of the trouble. There are instances beyond number in which the customer has been clearly and honestly forewarned of what he must do to get efficient results, only to utterly ignore or disbelieve the warnings. The problem lies deeper than this, quite apart from the fact that even if the truck does not live up to the most sanguine statements of the salesman, it should still (under normal conditions) give a more than satisfactory efficiency.

Nor is it primarily due to the fact that the wrong truck has been purchased for a given class of service. Certainly there have been a very great number of mistakes of that kind—mistakes which every man, in whatever capacity, who has the interests of the industry at heart, whether as user or maker, deplores and earnestly seeks to prevent.

Regrettable as such purchases are, it is nevertheless true that even where the truck is perfectly adapted, in style, size and equipment, to the required class of work, there is, in a large number of instances, a heavy loss in economy. It is in seeking to arrive at the underlying cause for this loss that we reach a basic solution of many of the problems of motor transportation.

It is the natural and logical reasoning of the salesman and the purchaser that if the truck itself is well designed and made (and in the present state of the industry there is an ample choice of such trucks); if it is the suitable type for the work in hand, and if it is placed in the hands of a competent man, it should prove to be an unqualified success. This reasoning, however, is not justified by experience.

An analysis, based on accurate time studies and investigations of operating conditions, of more than two hundred average motor delivery services, in twenty-eight cities, and in forty-two lines of business, each with unique problems, reveals as a generalization that the average motor truck is from twenty-five to fifty or even sixty per cent below normal efficiency.

A very small percentage of this is due to defects in the machines themselves. When repair bills or maintenance expenses are unduly high, they are not traceable, except in a few cases, to bad design or construction, but to careless use.

And the cases of error in selection of the type of truck, while considerably greater in number, still do not represent the major part of the problem. In fact, the most common error of this class, the use of too heavy a type for parcel service on short runs, is due primarily to a scarcity of suitable parcel-car types. In the heavier trucks it is apparent that because of the wide variations in weights and sizes of load units, some inconsistencies are inevitable, and the truck makers have provided for this by a reasonable factor of safety in construction.

The conclusion is, then, that the truck is not properly used by the purchaser in a large number of instances; a fact which has been blamed to the driver, the repair man, the garage superintendent—to every one, in fact, except the real source of responsibility—the management.

The adaptability of the motor truck to its work, barring certain minor considerations, resolves itself into the question as to the amount of intelligent effort the management is willing to expend on it.

There is no other way to account for such a comparison as Figs. 1 and 2. These represent total hours in service and the relation of working hours to idle hours, of a motor truck selected at random from the fleets of two companies situated near each other in a large city, with the same kind of tonnage, and the same make of truck. The comparison is as fair as could be made. Both drivers are above the average in ability and intelligence. Truck 1 is not profitable. Truck 2 is paying good dividends, in service fewer hours, and handling greater tonnage.

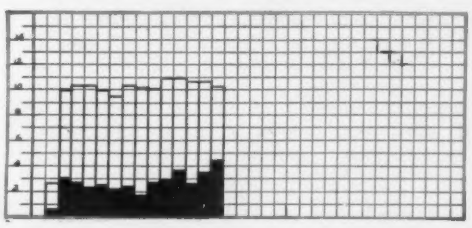


Fig. 1.—Relation of working to idle hours of a motor truck.

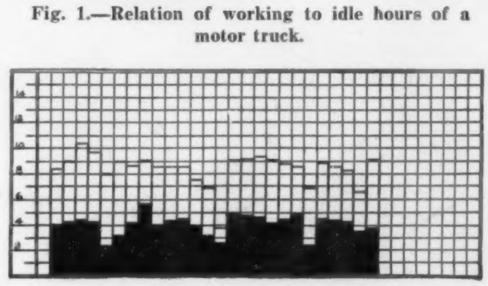


Fig. 2.—Diagram of a profitable truck engaged in the same work as Fig. 1.

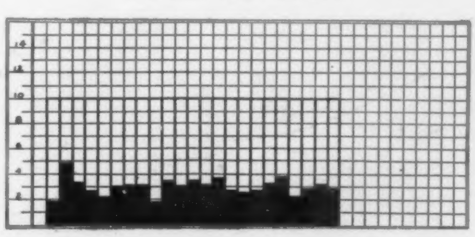


Fig. 3.—A thirty-day analysis of an unprofitable truck.

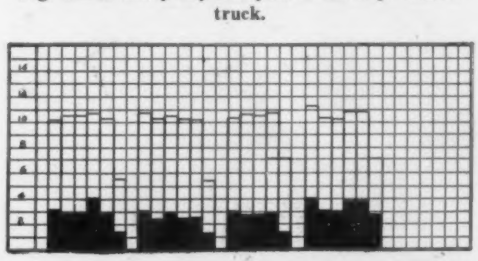


Fig. 4.—Same truck as in Fig. 3 after the management had investigated the delivery service.

Figs. 3 and 4 are the graphic presentation of a thirty-day analysis of similarly parallel conditions in another industry in a smaller city, before the attention of the management was directed to the delivery service in anything more than the usual perfunctory way. After analyzing tonnage, trips, necessary loading and unloading time, etc., it was apparent that increases in efficiency to average 28 per cent in productive working hours were possible, and within ninety days practically all of this increase was effected.

These will serve as illustrations of the principle underlying the economical administration of motor trucks, namely, the importance of the productive working hour. The generalization that a truck must be kept busy is currently accepted and preached broadcast, but there is an appalling amount of misinformation as to how much work the truck in question is actually performing.

Men who are conscientious in the belief that their trucks are rushed to capacity, and who are contemplating the purchase of additional vehicles, are utterly amazed to be confronted by indisputable evidence that their trucks stand idle as high as 60 or 70 per cent of the working day. In fact, those percentages might almost serve as an average.

Many of the secondary ills of the motor truck are traceable to that condition. Bad planning on the part of the management (or lack of accurate information) forces the shipping clerk to overload on each trip to get out the goods—a necessity which extra trips, in a well planned day, would eliminate. The driver is compelled to overspeed to meet the pressure. The result is high repair bills and bad service. The most common and serious mistake is in attempting to cure these symptoms instead of getting down to first causes and considering the motor truck as it should be considered—a unit of productive machinery.

Hundreds of owners are spending large amounts of money and time in keeping elaborate records of costs, and investigating cases of trouble, without recognizing that the same principles of planning and management that apply to the machines in their factories apply in the same degree to their motor trucks.

When a truck has been considered with respect to the weight and size of load units for delivery, the territory to be covered, and whether the load is for distribution or delivery at destination as a unit, and has been selected to conform to the conditions, the owner is still far from receiving satisfactory service unless he applies to it the basic theory of manufacturing efficiency—*the largest number of productive minutes of time per unit of machinery.*

Failure to apply this standard is accountable for the fact that there are relatively few fleets that do not contain more units than are necessary for the work in hand.

To take a concrete illustration, a large wholesale grocery company, operating four large trucks (three different makes) found their cost far above that of horse delivery. A time study showed that these trucks averaged barely three productive working hours a day, and the fault was shown to lie in shipping room congestion. The trucks were in no way at fault—they were giving splendid service. But to restore the delivery department to its old costs, or decrease them, it was necessary to improve shipping facilities or go back to horse trucking. By electing the former method, this company is getting the benefits of truck service at a normal cost.

By way of contrast is the concern which operates four trucks which were shown to average but two hours and twenty-five minutes a day of *running time,* yet who ignored the point and purchased two more trucks, when three trucks in all would amply care for the work under proper supervision.

Cases like these illustrations are not the exception. On the contrary, they are so frequent as to be a serious menace to the success of the motor truck. They are changing the motor truck from a powerful servant of society, cheap and efficient, to a costly and wasteful addition to the machinery of distribution.

And the process will continue until the owner learns to discard the standards of horse delivery and apply the principles of engineering to his equipment, and until the maker recognizes that it is not sufficient that he sell trucks to those who will buy, but that he must sell them where they are really needed, and only then.

As standards for the successful operation of motor trucks, it is logical to adopt the same principles of production engineering that apply to the lathe, the automatic screw machine, or any other piece of productive machinery. These may be summarized as follows:

1. The machine must be of exactly the right type for the particular class of work it is turning out.
2. No unit must be added, until each preceding unit is working to its capacity.
3. The raw materials of manufacture must be accessible with least possible expenditure of effort and time.
4. The finished product must be promptly removed.
5. The operator must be skilled in the use of the machine.
6. The machine must be subject to the frequent inspection of a competent mechanic. "A bolt in time saves breakdowns."

(Concluded on page 36.)

Good Lubrication—The Motor Conserver

Motor Oil in a New Light

By Harry Tipper

One thing which distinguishes the efforts of men in any direction from the accomplishments of nature, is the small amount of useful work secured by man in proportion to the amount of energy which goes to waste compared with the absence of waste in nature and the complete conversion of all energy into useful work of some kind. The actual amount of power turned into useful work in an automobile compared with the amount of energy represented in the fuel, is only a fraction of the theoretical possibility; neither is the length of life of the parts of an automobile anything but a fraction of what it should be.

Friction—that is, the resistance to movement of one part in contact with another—is one of the largest contributing causes to loss of power and deterioration, and as a consequence of this the effect of lubrication upon the wear and tear, the ability of the motor to withstand strain, and the power delivered, is of the utmost importance and can hardly be over-estimated. Even the spring which supports the body will remain in service infinitely longer if a little care is bestowed on the lubrication between the leaves, so that the movement of one leaf upon the other will be unrestricted and without undue strain upon the metal.

The efficiency of lubrication in any motor driven vehicle depends only to a certain extent upon the character of the oil, other factors exercising a considerable influence upon the results which are obtained. The design of the motor, the design of the lubricating system, the care bestowed upon the running of this system, the character of the oil itself, the care bestowed upon it in refining and distributing, all exercise an influence upon the lubrication and its value as a conservation measure. In this article, written by a well known expert, the importance of good lubrication in automobile operation is considered from a new angle.—Editor.

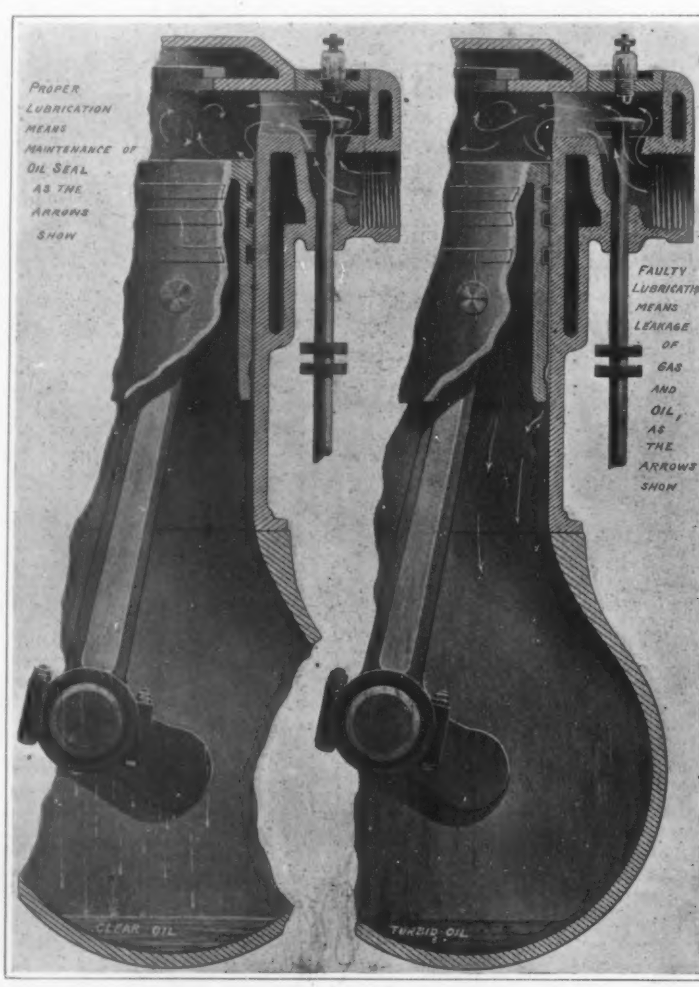
CONSERVATION measures are always the least understood and the last to be investigated. It is, therefore, to be expected that comparatively little study should have been given to the question of lubrication except in the oil business, and only a partial study has been given to it even in that business. Primarily because the study of lubrication in the oil business has been from the standpoint of determining the best way to market certain oils and not always from the standpoint of arriving at the most efficient means of lubricating. This is, of course, to be expected. It does not, however, excuse the engineer who is interested in motor lubrication from the criticism which the neglect of this important subject rightly subjects him to. Little, if any, attention has been paid by the automobile engineer (until the last two years) to the factors which enter into and affect the efficiency of lubrication, and where these factors have been taken into account by the oil manufacturer they have been considered only as exercising a controlling influence upon the character of the oil required. Whereas, it is entirely probable that the character of the oil adapted to the work is not materially affected by the changes in the design of the motor, the lubricating system or other conditions, but rather these conditions have an effect upon the final efficiency of any lubricating oil which is used.

Moreover, where attempts have been made to scientifically consider the character of the oil necessary for efficient lubrication, the conclusions reached and the deductions made from such consideration generally show either a partial knowledge of the conditions in the oil business and the requirements of the motor, or a neglect of some of the factors entering into the case. It is not many years ago that gasoline of high gravity was considered necessary to secure any power, although now it is generally understood that a lower gravity gasoline means greater power and more mileage per gallon and that gravity may change in the gasoline produced from different crudes without affecting the starting value or volatility of the product. These later developments have shown definitely that the characteristics by which the general public (and even the trained engineer) have been used to measure gasoline have little, if any, bearing upon its value as a motor fuel.

Physical Tests Are Not Always Final.

It is now understood by some oil experts (who have conducted their researches very carefully into the conditions in a number of oil fields and conditions in the motor business) that some of the physical characteristics of lubricating oil which are generally quoted as being synonymous with good lubrication, have little to do with the mechanical efficiency of the lubricating oil under working conditions. In this respect oil values are much like creeds and political traditions, the old habits of expression remain long after the deficiencies are known.

Many years ago, when the crude oil all came from the same part of the country and possessed practically the same characteristics, chemical composition, etc., it was a comparatively easy matter to determine whether a uniform oil of uniform value was being secured. Consequently, the crude oil from which the lubricants were taken at that time passed into the standard, and the general physical characteristics were used as expressing the standard of requirement. Later discoveries in oil fields have shown that, like all natural products, oil varies in its chemical and physical characteristics, according to the deposit, and these varying deposits cannot be measured solely by the values established by the characteristics of one field. On account, therefore, of the absence of any valuable standard of comparison in the oil business, and the conflicting opinions which have developed in the study of motor lubrication, the only way to properly consider this subject is to ask what the requirements are and see what qualities are necessary to fulfill them.



If the seal between the piston rings and cylinder walls is good, the mixture will be compressed to a high degree. In order to maintain good compression in the cylinder, an oil must evidently be used which will adhere to the cylinder walls, filling the space between the piston rings and the cylinder walls. If there is a slight leakage on each compression stroke, gasoline may seep into the crank case, making the oil absolutely unfit for further use.

The effect of good and bad lubrication in an automobile engine.

How Lubrication Affects Compression.

Inasmuch as most of the obvious trouble in connection with the lubrication of motor driven vehicles comes from the motor cylinders, this point should be considered first. The performance of the motor of any gasoline driven vehicle depends upon the maintenance of the compression, and the efficiency of the motor depends to a considerable degree upon keeping this at maximum point.

It is obvious, upon consideration, that it is practically impossible to fit the moving piston into the cylinder so closely as to secure a high compression without increasing the resistance or friction to such a point that it will absorb a considerable amount of power in turning over the motor without doing any useful work. During the suction or admission stroke, the admission valve is so arranged that it will not admit air into the cylinder as fast as the piston displaces it. This results in creating a partial vacuum which carries the gasoline and air mixture through the carbureter. This partial vacuum will at the same time carry the lubricating oil up past the piston rings into the compression chamber unless this oil is sufficiently tenacious to adhere to the cylinder walls.

The amount of lubricating oil which passes the rings and gets into the explosion chamber during the stroke is greater or less according to the fit of the piston rings in the cylinder and to the character of the lubricating oil. These same conditions—that is, the fit of the piston rings and the character of the lubricating oil—affect the compression, which can be secured and maintained during the next stroke. The compression which occurs during the next stroke is caused by the movement of the piston upward in the cylinder and this compression depends largely upon the close fit between the piston rings and the cylinder walls; upon the number of rings; and upon the way in which the oil will form a seal between the cylinder walls and the piston rings. When the cylinder is closed, the only loss of compression comes through the fit of the valves, poor mechanical fit of the piston rings or poor and faulty lubrication.

The lubricating oil may be indirectly the cause of poor mechanical fit of the valves and piston or rings on account of hard carbon being deposited thereon. Poor lubrication, even with a good oil, will result in a loss of compression without regard to the perfect mechanical fit of the piston rings. With good lubrication and an oil of the right character, the compression can be maintained even with worn-out rings and a loose piston.

On the next stroke, the explosion of the mixture and the consequent expansion of the gases therefrom produces the power to drive the motor. Provided the carbureter is properly adjusted so that the mixture is in the right proportion for effective work, the amount of power developed from the explosion is largely dependent upon the compression secured during the second stroke; the greater the compression secured during that stroke the greater will be the initial pressure at the time of explosion, and consequently the greater the force of explosion.

If the seal between the piston rings and cylinder walls is maintained perfectly, the mixture during the second stroke will be compressed to a high degree. At the same time, during the explosion or power stroke none of the force (which should be expended in driving the piston down) will be lost through leakage past the piston rings. Of the power developed by the motor, the percentage which can be used to drive the motor forward, is dependent not only upon the degree of compression, but also upon the way the compression is secured. In other words, in order to turn the power developed by the explosion and the expansion of the gas into useful work, it is

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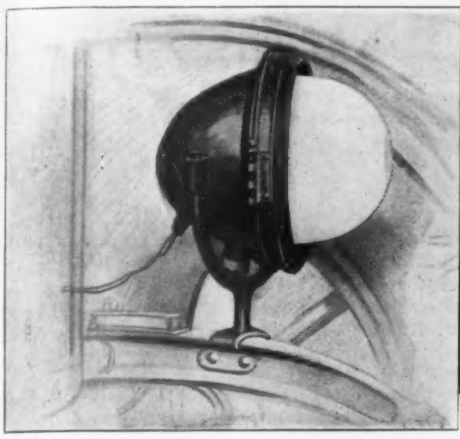
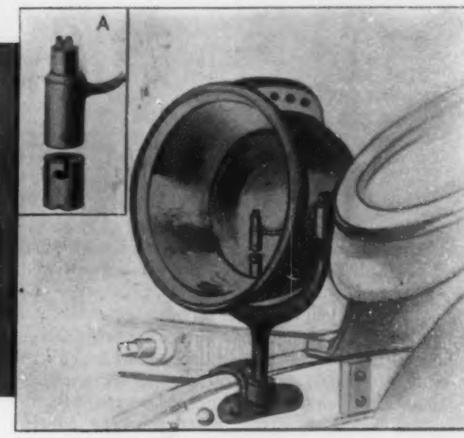


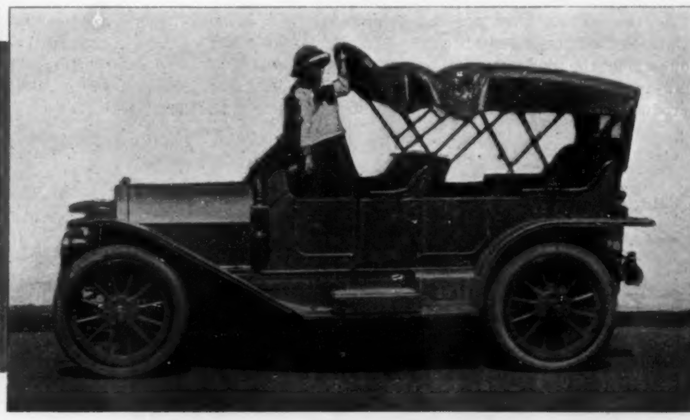
Lamp that illuminates roads without blinding others.
It has been one of the problems of those who design automobile headlamps to provide for proper illumination without blinding those who approach the lamps. In this design the solution has been attempted by showing the brightest part of the light against a light background instead of against the usual dark one. The front domes are ground glass with a small central clear portion.

An adjustable windshield for tonneau passengers.
Few automobiles, if any, are sold without a windshield for the driver's protection, yet none are provided with a similar device for the protection of those who ride in the tonneau. This shield has been designed for the purpose. It is light and easily fitted to any body and can be adjusted to occupy a variety of positions. When not in use it is removed, taken apart and packed into a small case.

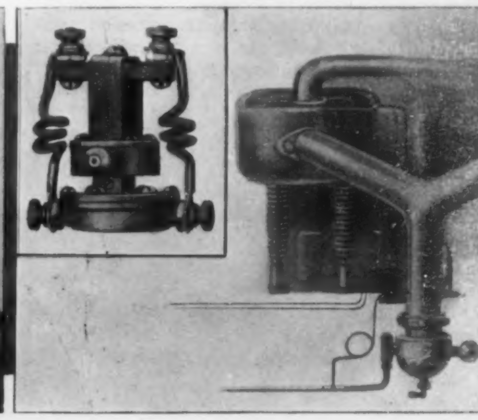


Emergency burner to make electric lamps burn gas.
We have had devices which transform gas and oil lamps into electric ones and now comes the device which makes an electric lamp into a gas lamp. It is for emergency use, of course, and manifestly cannot be used in the ordinary type of parabolic reflector lamp. The pillar is made to fit the usual electric light socket and can be quickly substituted for an electric light.

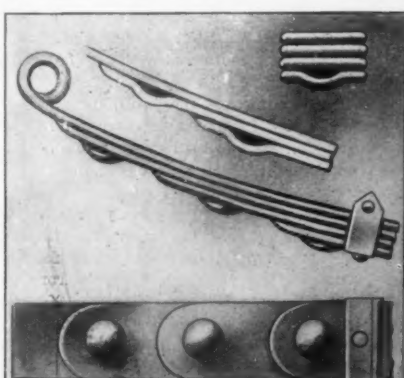
Heater built like a miner's lamp.
It is not a stove, however. Warm air is discharged at the top, but the sides do not get hot. It burns gas and is so arranged that hot air is kept in circulation, though the vent is outside the building. The makers say it cannot cause explosions.



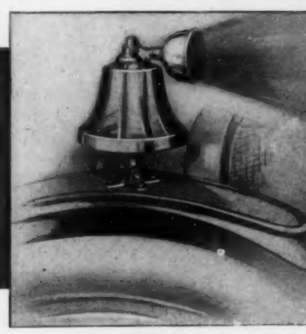
Top that can be raised or lowered by one person without assistance.
The job of raising and lowering automobile tops always has been a difficult one. Usually it requires the undivided attention of at least two persons. With this design, however, one person can not only raise or lower the top without help, but, it is claimed, can do either with two fingers in about ten seconds. It is worthy of note that a great many automobile makers are equipping their cars with tops of this kind for the coming season, the movement, in fact being one of the revelations of the new models. The new top is supported only at the rear.



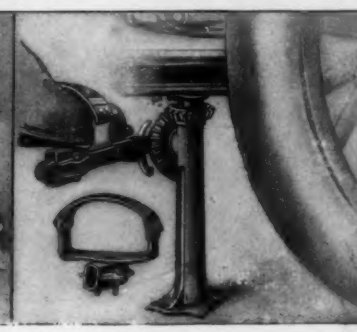
Electric device that helps the engine start itself.
We all know how hard it is to start a cold motor on a cold morning; not even the electric engine starter finds it an altogether easy job. So this device has been developed to assist in starting the engine. It is an electric heater operated from a storage battery. Pressure on a button permits a small quantity of fuel to pass over a heating coil which vaporizes it and fills the manifold with hot "mixture."



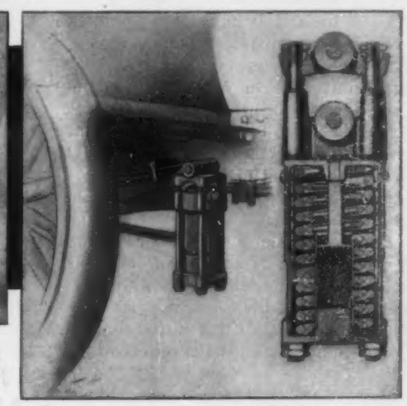
Providing automatic spring lubrication.
It is gradually coming to be realized that the leaves of springs require continuous lubrication to avoid squeaks and hard riding. The maker of this spring has overcome the difficulty by forming small grease receptacles near the end of each leaf. They are filled with hard graphite grease every six months, and the movement of the leaves one on the other serves to distribute the grease and provide proper lubrication.



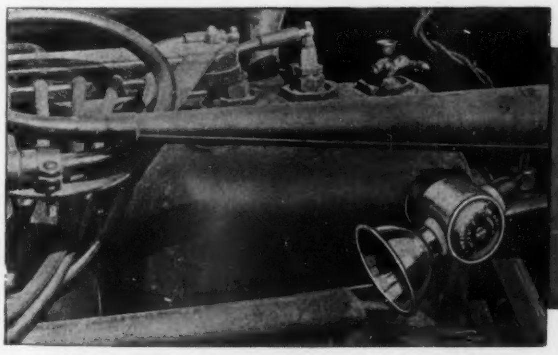
Signal appeals to two senses at once.
It is said that even the deaf take note of this combined bell and signal lamp! The lamp is in series with the bell, and when a button is pressed current from a battery rings the bell and flashes a red or green signal to draw the attention of pedestrians. Obviously it serves its most useful purpose at night. To satisfy the nautical mind, two signals can be used, red for left and green for right, with separate controls.



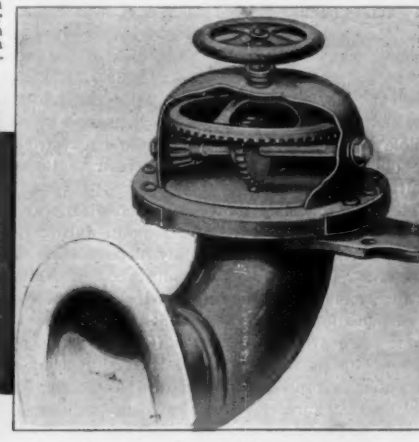
Jacking up the car by foot power.
Nearly every one knows how hard it is to operate a jack by hand under a rear gasoline tank, for instance; the foot is much handier for the purpose, so to speak. This is a stirrup which fits onto the handle of any jack so that the operator can insert his toe into it and hoist the car with his powerful leg muscles—and keep his clothes clean. For really heavy vehicles, strong biceps are needed when the jack is hand-operated.



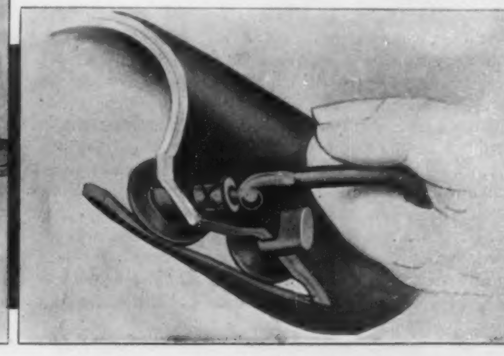
To smooth out little bumps in the road.
The light springs preserve the chassis from the little jolts not absorbed by the regular vehicle springs, and at the same time act to reduce their natural period of oscillation. The large spring chamber is filled with oil which lubricates the parts and also prevents too rapid motion, thus giving a shock absorbing effect. The device takes the place of the common variety of spring shackle.



Novel type of "trouble" lamp that stays where it is put.
Magnetism is what makes it "stay put," which means, of course, that it must be "put" on either iron or steel. As the powerful magnet that holds the lamp is in multiple with the four-candle-power bulb, the outfit does not take much current; four dry cells are sufficient. Though designed primarily for the motorist it is a handy thing to keep about the shop. Needless to add, it will stick in any position, upside down or otherwise, and as the magnet exerts a pull of thirteen pounds it is not easily shaken loose.



New idea in mechanical horn construction.
The old-fashioned bulb horn does not emit a note sufficiently abrupt and compelling; its tone is too mild to be heard above the roar of traffic. This horn is one of the simplest that has been devised to take its place. Twirling the handle sets in motion a series of gears, thus causing a steel wheel to rub over a button on the diaphragm.



An ingenious puncture repair outfit with a new plug.
The outfit consists of a tool to insert the plug in punctures and the plug itself which differs from all others in that the stem is flat and the head round. Small punctures are made into tiny slits with a knife, after which the plug is inserted with the tool which first pushes the plug through the slit, then turns it and withdraws the stem. The tube, being larger than the slit, and elongated when inserted, expands when in place and fills the hole.

NEW IDEAS IN AUTOMOBILE ACCESSORIES

The Heavens in January

Some Notes on the Planets and Their Satellites

By Henry Norris Russell, Ph.D.

THE comets whose discovery and motions have occupied so much of our space of late are now all well on their way outward from the Sun, and with one exception, are no longer visible in small instruments. Westphal's comet alone remains in the northern sky—its computed position being right ascension 21 hours 25 minutes, declination 57 degrees 50 minutes north on December 31st and 22 hours 10 minutes, 64 degrees 44 minutes on January 12th. It is now about 125 million miles from the Sun and one hundred million from the Earth, and, theoretically, should be about one third as bright as in November, and should fade away slowly. But the actual brightness of a comet is a capricious thing, for, unlike a planet, it shines by its own light. It is certain that the comet is stirred up to shine in some way by the action of the Sun's radiation upon it; but the nature of this action is not yet well understood, and the brightness, and even the apparent size and shape of a comet, often vary greatly in a short time.

Westphal's comet has given a good example of this. In October it was conspicuous in a small telescope. Early in November, however, as Prof. Barnard described it, "it simply went to pieces," becoming a faint, vague, elongated mass of feeble light some two minutes of arc in diameter, and since then it has been faint. There is no longer any chance of its becoming visible to the naked eye at this return, but unless it continues to grow unaccountably fainter, it should be telescopically visible for some time to come.

The principal interest this month shifts to the planets Mars and Saturn, which are splendidly placed for observation in the evening sky. Saturn is in Taurus, about 8 degrees northeast of Aldebaran at the beginning of the year, and moves about 1½ degree westward during January. Mars is farther west, in Gemini, not far from Castor and Pollux, and moves some 8 degrees westward during the month.

Both planets are very conspicuous, Saturn shining with a yellow light and appearing a little brighter than Capella, which is, next to Sirius, the brightest star now in sight. Mars is almost equal to Sirius in apparent brightness, and may be recognized at once by his fiery red color.

Saturn is a month past opposition, and is already well up by nightfall. Mars is in opposition on January 5th, and is visible all night long. He is then almost 27 degrees north of the celestial equator, and hence he soon rises high in the sky, and is well observable in the early evening.

Both planets are splendid telescopic objects. Saturn's rings are opened out at their widest, extending beyond the poles of the planet on the north and south. It is on this account that he appears so bright. Seven years ago, when the rings were edgewise toward us, and we received light from the planet's ball alone, he appeared to the eye only half as bright as now.

His largest satellite, Titan, which is easily visible with a three-inch telescope, can be found north of the planet on the 4th, west of it on the 8th and so on, its period of revolution being 16 days. When north or south of Saturn its apparent distance from him is twice the extreme length of the rings, and when east or west of him, four and one half times the length of the rings. The satellite's orbit is really almost circular; but since its plane (which coincides with that of the rings) makes an angle of 26 degrees with our line of sight, it appears foreshortened into an ellipse of the same shape as the rings themselves.

The next nearest satellite to the planet, Rhea, which is a little less than half as far away as Titan, is east of the planet on the evening of the 1st, and at intervals of 4½ days thereafter; but to see it requires a somewhat larger telescope.

A recent bulletin from the Harvard Observatory reports that Prof. Wendell's photometer measurements show that Titan varies in brightness, being 20 per cent fainter when on the farther side of the planet than when on the nearer side. This shows that the satellite always keeps the same side toward the planet, and that this side is darker in color than the other.

The remotest satellite, Iapetus, has long been known to vary in a similar manner, but its range is much greater. It is four times as bright when west of the planet than when east of it.

Mars also has satellites—a pair of tiny attendants, very near him—but these are too faint to be seen with any but very large telescopes. The amateur observer must content himself with the study of the more conspicuous markings of the planet's surface, the dark areas, formerly called seas, and the white polar caps. The fact that the dark regions never reflect to us the brilliant patch of sunlight which they would certainly do if they were covered with standing water is a sufficient proof that (at least in the equatorial regions of the planet) they are not really seas.

Prof. Barnard, observing with the 60-inch telescope at Mount Wilson during the last opposition, describes their appearance under favorable conditions by saying that the planet "gave one the impression of a globe whose entire surface had been tinted a slight pink color, on which the dark details had been painted with a grayish colored paint, supplied with a very poor brush, producing a shredded or streaky and wispy effect in the darker regions." With a small telescope one can only hope to see the larger outlines of these dark regions, but it is interesting to follow their motion from east to west across the disk as the planet rotates, the change being conspicuous in a couple of hours.

At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.
At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.
At 9½ o'clock: January 29.

NIGHT SKY: JANUARY AND FEBRUARY

As the period of rotation is 24 hours 37 minutes 23 seconds, we see almost the same side of the planet on one night as we did at the same hour on the night before, but not exactly, the difference in the Martian longitude of the central meridian being 9 degrees. The visible region therefore works slowly backward around the disk, taking forty days to return to its original position.

The conspicuous polar caps, which disappear during the Martian summer, and form again during the winter night, are pretty certainly deposits of snow or hoar-frost. The only other substance of which it is at all reasonable to suppose that they may be composed is carbon dioxide, which solidifies at a temperature of about 80 degrees below zero (Cent.). The temperature of the polar regions of Mars during their long day, though probably a good deal lower than that of the Earth's surface, can hardly be as low as this, and it is therefore probable that the polar caps consist of frozen water in some form. It is, however, not certain whether with the amount of heat which Mars receives from the Sun, its polar regions can ever get quite warm enough to melt snow. But Prof. Newcomb cleared up this difficulty some years ago by recalling the fact that snow, like camphor or other volatile solids, may slowly evaporate into dry air at temperatures considerably below the freezing point. This removes the last objection to the theory that the polar caps of Mars are actually layers of snow. They must be very thin to melt off entirely, or evaporate off, under the feeble rays of a Martian summer, and this accords with the fact that Campbell's observations show the quantity of water vapor in the Martian atmosphere to be very small.

At the present opposition, both the Earth and Sun are near the plane of Mars' equator. We see both the northern and southern polar regions of the planet, very much foreshortened, at opposite sides of the disk. The Martian season corresponds to the beginning of April on our planet. The northern pole is just beginning to catch the sunlight, while the southern one is entering upon its long night. The northern polar cap will, therefore, be of considerable size, while the southern regions will be clear of snow.

The Heavens.

In the latter part of the evening, as our map shows, Saturn will be a little west of the meridian, and Mars a little to the east of it, both being very high in the sky.

Orion and Canis Major are below them, due south, and shining brilliantly. Far below them is Argo, whose brightest star, Canopus, second only to Sirius in brilliancy, can be seen on the southern horizon from points south of Virginia. Canis Minor, Leo, and Hydra are the most conspicuous constellations in the east, Ursa Major in the northeast, Draco and Ursa Minor in the north, Cassiopeia in the northwest, and Andromeda and Aries in the west, while Perseus and Auriga are almost overhead.

The Planets.

Mercury is morning star at the beginning of the month, rising rather less than an hour before the Sun. Soon afterward, he disappears from the morning sky, and passes through superior conjunction, behind the Sun, on the 25th, to appear as an evening star next month. Venus, too, is a morning star, but is approaching conjunction, and too near the Sun to be easily seen. On the 13th she is in conjunction with Mercury, and the two planets, which are moving in the same direction in the heavens, are within 2 degrees of one another for several days; but both are too near the Sun to be easily seen.

Mars, as we have already mentioned, is in opposition on the 5th. Though very far north, and thus well placed for observation, he is much farther from us than he was at the oppositions of 1907 and 1909—for then he was in the part of his orbit nearest the Sun when the Earth overtook him, and now he is not far from the remotest part. Jupiter is in conjunction with the Sun on the 20th, and is invisible this month. Saturn is in Taurus, visible until shortly before sunrise, as already described.

Uranus is in conjunction with the Sun on the 28th, and cannot be seen. Neptune is in opposition on the 17th, and is well observable with a telescope. His position in the heavens is as follows:

	R. A.	Dec.
January 1	$7^h\ 57^m\ 4.2^s$	$+20°\ 16'\ 24''$
January 17	$7^h\ 55^m\ 12.9^s$	$+20°\ 21'\ 41''$
February 2	$7^h\ 53^m\ 21.1^s$	$+20°\ 26'\ 59''$

The Moon.

The Moon is in her first quarter at 8 A. M. on the 4th, full at midnight on the 11th, in her last quarter at 7 P. M. on the 18th, and new at 2 A. M. on the 26th. She is nearest us on the 15th, and farthest away on the 3rd and the 31st. In her circuit of the sky she passes near Saturn on the 8th, Mars on the 10th, Neptune on the 11th, and Jupiter, Venus, Mercury and Uranus on the afternoon of the 25th and morning of the 26th, within a few hours of each other. At this time all four planets, the Moon and the Sun, all lie within a circle 7 degrees in diameter.

Almost as this article is sent to press, comes a telegram announcing the discovery of another comet by Delavan at La Plata, who was the first to detect Westphal's comet on its return: On December 17th the new comet was in 3 hours 3 minutes right ascension and 7 degrees 25 minutes south declination and was described as "visible in a large telescope," so that it must be faint.

Princeton University Observatory.

The Wright Automatic Stabilizer for Aeroplanes

Merits and Faults of the Patented Device; How the Actual Stabilizer Differs From That of the Patent

By Carl Dienstbach

THERE are two problems still awaiting a really satisfactory solution, for they block the way to a commercial utilization of all the wonderful achievements in aerial navigation. One of these problems involves the invention of the safe flying machine; the other, the economical docking of the speedy mammoth dirigible. Making the aeroplane safe is largely a matter of providing an efficient stabilizer. It is not without significance that the tenth anniversary of the first power-flight, is marked by the grant of an American patent for an automatic stabilizer, invented by none other than the Wright brothers, to whom we owe the creation of the first man-carrying motor-driven aeroplane.

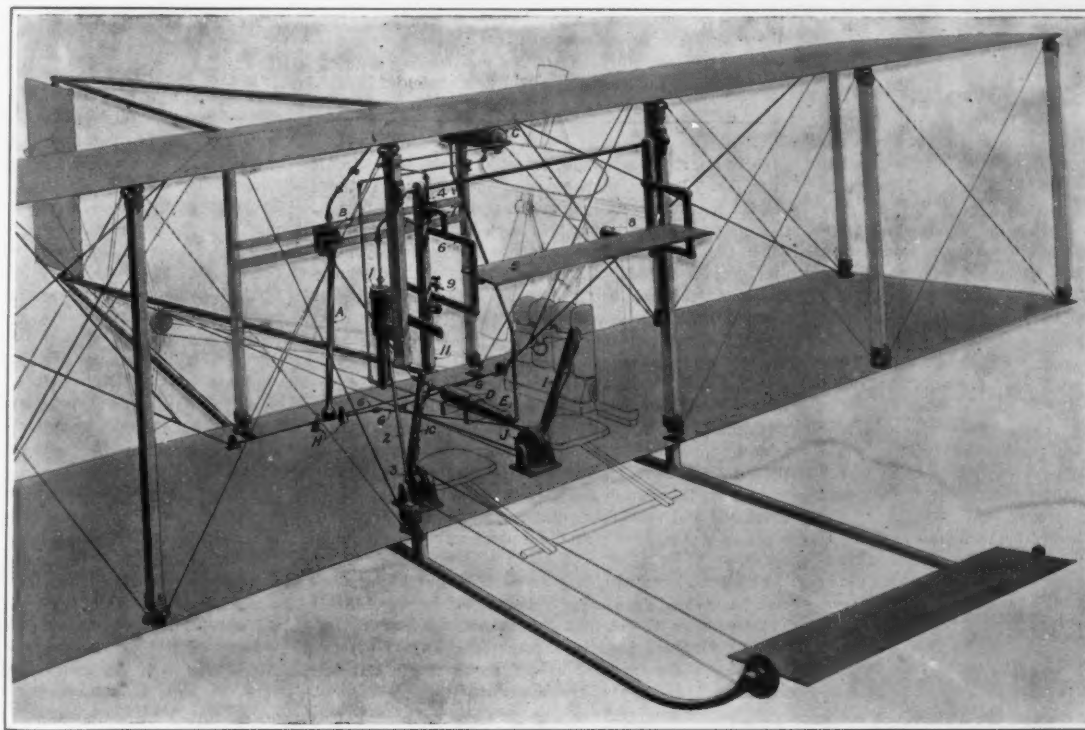
It is also significant that this is only the second innovation in the Wright machine of 1908. It is announced that this apparatus will be soon in practical use.

The first departure from the original Wright type was the adoption of a modified "open work" Blériot tail and rear elevator, and the Farman wheels, rather a poor recompense for the wholesale appropriation by the French of the Wright side control. The Wright stabilizer, described in the patent specification, is very simple. Although the apparatus actually built departs somewhat from the patent, still the principle of the invention as revealed in the patent is retained. One is immediately struck with the simplicity of the apparatus—a simplicity which, paradoxically enough, may be the principal obstacle in the attainment of efficiency. If an automatic stabilizer is intended to supply "mechanical brains," it might be expected to show a greater resemblance to a scientific instrument of precision—such as a gyroscopic compass for example.

This stabilizer really embodies two entirely distinct inventions. On the other hand the theoretical conditions of longitudinal stability are absolutely different from those of transverse stability.

The device for obtaining transverse stability mainly embodies the conception of a stabilizing pendulum and its functions. The pendulum *a* is connected with a threeway valve *b*, which by its movement, admits compressed air from an air tank *c* to a servomotor *d*, or allows it to escape from that motor, or locks it in the cylinder and blocks the piston. By means of a connecting rod *e*, working in a slot, and a windlass *j*, the piston pulls on the interconnected cables *g*, which work the warping mechanism and the vertical rudder. The principal novelties are stops *h*, to check the pendulum. They eliminate erratic swinging, but on the other hand restrict this mechanical mind to signifying only "yes" or "no," like a simple Quaker.

There is no grading of effect. The least swing of the pendulum will set the side control going with its maximum energy. A light puff of wind will thus be counteracted with all the force required for the most severe gust. This seems like borrowing trouble. The tremendous action of the side control, having almost nothing to resist it but the considerable inertia of the wide distribution of weight in a transverse direction, which is sufficient to prolong the action of the mechanism considerably, will impart so much momentum to the heavy machine in turning it around a longitudinal axis, that in spite of instant reversal of the pendulum control, after the horizontal position has been again attained and passed, it must inevitably overshoot the mark, and come to rest only with its side balance worse disturbed in the opposite direction.



The letters refer to the mechanical elements of the transverse stabilizer; the numerals to those of the fore and aft stabilizer. The pendulum rod *A* is connected with a threeway valve *B*, which admits compressed air from a tank *C* to a servo motor *D*, or allows the air to escape from that motor, or locks the air in the cylinder to block the piston. By means of a connecting rod *E*, working in a slot, and a windlass *J*, the piston pulls on the cables *G*, which warp the wings and operate the rear rudder simultaneously. Stops *H* limit the swing of the pendulum. The horizontal rudder for maintaining longitudinal stability is worked by a servo motor 1, connecting rod 2, windlass 3, and threeway valve 4. A small plane 5, mounted at a different angle from the main planes is allowed to yield by the parallel motion frame 6, connected with the threeway valve 4 by a rod and lever 7.

The device invented by the Wrights to balance a flying machine automatically.

It seems for this reason that the machine's return swing under the reversed action of the pendulum should be more violent than the first, because the second action of the pendulum must last longer than the first. And so on should the rocking of the machine become increasingly worse, just as in a very high flower vase with a small base, if it once begins to rock, will increase the amplitude of the swings until they move the center of gravity beyond the support, and the vessel topples over. But there is one compensating action in this process. If an aeroplane is thrown out of side balance by an unwarranted action of the control, it will begin to slide down sideways, just as surely as when the loss of balance is due to unresisted wind force. This sliding in turn will reverse the pendulum's action even before it has brought the machine back to (and fatally beyond) a horizontal position. This seems to explain why a newspaper report has it that "in practice the device was promising but required more experimenting." Certainly its action is not so simple in theory as stated in the patent specification. It could easily be made to work more elastically if a spring were added to restrain the all too ready pendulum.

In real gusts or in turning the side slip becomes detrimental instead of beneficial, causing the mechanism to share the inherent fault of all pendulum devices which was pointed out so clearly by Prof. Prandtl. Probably this device may be developed to supplant the pilot only in calm air, and as it moves the control only by friction it can be overruled in gusts by the ordinary hand lever *i*. It will then resemble Moreau's "aerostable," which also depends on pendulum action in calm air but which is controlled by hand in gusts, the automatic action, however, being graded in exact proportion to the disturbance to be resisted.

The invention may then become only a labor saving device for the pilot—as much of a convenience, as though in a teaching machine with double controls, of which one set can be mechanically overruled by the other, a master pilot had his passenger do the ordinary stabilizing and saved his own energy for emergencies.

As the horizontal rudder for maintaining the longitudinal stability is worked by an identical servomotor 1, with connecting rod 2 and windlass 3, which is likewise controlled by a threeway valve 4, defects similar to those of the automatic side control might be expected, although the inventors themselves considered a pendulum, which is affected by any change of speed just as much as by changes of inclination, unsuited for controlling longitudinal stability, and substituted for it what the French would call an "*empennage déplacée.*"

A small plane 5, is mounted at a different angle from the main aeroplanes. Like a non-lifting tail it will receive air pressure from above or below whenever the main planes change their angle of attack, and, as it is allowed to yield by the parallel motion frame 6, which is connected with the threeway valve 4 by a rod and lever 7, it will resist any such change in the angle of attack, not like a tail, by its own surface and leverage, but by the machinery it controls, which machinery promptly sets in motion the horizontal rudder. Apart from such faults as easily ensue from inadequate action of the machinery, such a stabilizing plane is naturally subject to all inherent defects of a stabilizing tail, with one praiseworthy exception.

Like the use of a tail it fundamentally presupposes that the stabilizing surface is washed by the same air-stream as the main planes. The "internal work of the wind" defeats this theory. But the stabilizing plane here shown has the one great advantage over a tail of being next to the main planes and much more subject to the same up and down trends of the relative wind. Nevertheless, the difference of size remains a stumbling block, just because this plane's mechanical action is so much more violent and sudden than the simple stabilizing effect of a tail.

What we call air pressure on an aeroplane is only an abstract notion because we imagine it as uniform. In reality it is an average of many different and changing impulses on the several units of surface. Consequently, a small plane, even close to a large plane, will not be, as a whole, affected in the same way by the same wind as a large one, as soon as the "internal work of the wind" becomes at all energetic. This is dangerous, if (just as in the case of the pendulum) a slight movement of the plane will set the rudder in full operation. A purely local change of trend in the wind, which does not affect the main planes at all, may thus result in a violent stabilizing action for which there is neither an object nor a resistance. This will start the same increasing oscillations as the pendulum action, softened (in comparison with the lateral stabilizer) by the concentration of weight in a longitudinal direction, but aggravated by the plane, unlike a pendulum, its action not being beneficially reversed by the change of speed resulting from the alternating gliding down and climbing during longitudinal oscillations.

A rather needed remedy would seem to be the addition of a spring restraining the too ready movements of the stabilizing surface and grading its effect. This would represent a very curious analogy to the cushioning of a Pénaud tail, as practised by Chanute-Herring and Langley-Manly for the identical purpose of making a small stabilizing surface less subject to the "internal work of the wind." Manly and Herring have both stated to the writer, each without knowing of the other's experience, that properly adjusting the tension of the spring was the essential thing. A spring would also do away with the need of the counterbalancing weight 8, and its harmful inertia and momentum.

The proper refinement of the device would seem to consist in employing not one comparatively large stabil-

(*Concluded on page 36.*)

Modern Electric Engine Starters and Electric Illumination Systems

Their Significance in Modern Motor Car Construction

By Walter Bannard, M.E.

When, more than a dozen years ago, a man with the germ of an idea succeeded in attaching a small electric motor to a heavy gas engine in a way that would permit the engine to be started quickly and easily, he sensed the feeling that some day would come to the owners and operators of motor cars; he expressed in a crude way the thought that in some enlightened day, owners of cars would demand that all the labor attendant upon their operation be eliminated; that the engine be made "self starting" in so far as that is possible. It was the beginning of the mechanical engine starter era. Since then, the mammoth automobile industry has swept fairly rapidly through compressed air starters, ignition starters (under which head come the various acetylene gas and gasoline vapor devices), spring starters and the numerous mechanical contrivances designed to render easier the attainment of the initial explosions by placing at the driver's hand, as he sits in his seat behind the steering wheel, some means whereby he can rotate the crankshaft of his engine. In this article the development of the starter is traced and its importance estimated.—Editor.

IT was not until two years ago that the engine starting movement gained any real impetus, when practically without exception car manufacturers took to the acetylene starter about as quickly and easily as a duck takes to water; they literally stampeded for it, and for a time all other types of starters dropped almost completely out of sight. But the acetylene starter was inadequate for the reason that it was not 100 per cent efficient. Few car owners were willing to accept its approximate 98 per cent of efficiency as representing a true solution of the engine starting problem. Hence, manufacturers cast about for something else.

The insistent public demand, stimulated by the promise of the acetylene starter, practically forced action which might have been delayed for a considerable period. The compressed air type of starter offered possibilities and a number of manufacturers proceeded to substitute it for the acetylene starter, and, but for the budding of another popular clamor, which once more turned the tide of inventors' efforts, pneumatic devices might now have been in the majority.

But on the head of the demand for starters there came an equally insistent demand for electric lights as representing still another step toward the elimination of the operator's labor, and a palpable improvement over the old style oil lamps. The necessity for providing a dynamo with which to charge the accumulator necessary for electric illumination immediately suggested, or rather reopened the dormant suggestion of a dozen years back, of providing for electrically starting the gasoline engine.

With both dynamo and storage battery in the equipment of the car, it was but a short step to add a tiny electric motor for starting. Hence, passing over the trials and tribulations of those who sought to perfect the application, and succeeded in doing so, the electric engine starter, after scarcely more than two years development, now is supreme. There is scarcely a car manufactured—large or small—that is not fitted with an electric engine starter, and if proof is needed that it has ousted all other types, it need only be added that three very prominent makers of comparatively high-priced cars who always have pinned their faith to the pneumatic starter, have for the first time this year cast it out in favor of electric systems.

Advantages of the Automatic Starter.

It is scarcely necessary to enlarge upon the advantages of the engine starter, quite regardless of its kind: The elimination of manual labor and the attendant risk of injury to the operator; the ability to start the power plant from the driver's seat with all the controls within reach of the man *in* control; the wiping out of the hazard of motors that stall in front of fast-moving railroad trains or other vehicles; in short, the *safety* of the device. All this is fairly well known.

Nor need any one of average intelligence look at the modern electric system askance as being, perhaps, beyond the ken of the man in the street. Thanks to the efforts of designers, it is, in truth, beautifully simple. It seldom, if ever, requires attention. Therein lies its value. The electric lighting and engine starting system in the abstract includes a storage battery of three, six or nine cells—seldom more—a self-regulation charging generator, which is quite automatic in action, and the starting motor.

The battery, as a rule, is carried in a special frame beneath the body of the car (Fig. 2), though it may be carried on a running board, under a seat or in any other convenient place. In determining its capacity, it is a general practice to consider the necessity for carrying the full lamp load with the engine idle for a given length of time. It must be capable of delivering a heavy current for short periods, as when starting the engine. One well known engine starter of the six-volt type, for example, draws 100 amperes when rotating at 200 revolutions a minute the crankshaft of a four-cylinder engine whose cylinders measure 3¾ by 4½ inches; the gear ratio is seven turns of the starter to one of the engine crankshaft.

The generator must be self regulating and there are several ways in which this may be accomplished. One method that is followed by several well-known makers is to govern the speed of the armature, using a centrifugal device operating a friction clutch; this has been found to work well. Other methods consist of varying the resistance of the field, to govern output, either in the method of winding the machine, or electro-mechanically by means of solenoids, centrifugal devices (Fig. 1) or magnets, a common way being to rely upon the resistance of a pile of carbon disks which are held tightly together under the action of a spring and drawn slightly apart by a magnet inserted in the field circuit (Fig. 8). In one machine, the increasing resistance of iron wire under heat is relied upon to shunt part of the current through what is styled a "bucking coil" when the speed of the armature increases beyond a predetermined limit. To prevent the battery discharging itself through the generator when the engine is stopped, the electro-mechanical cut-out (Fig. 8) is most in use, though some makers use centrifugal devices; the latter are uncommon, however.

Owing to the inherent characteristics of the series wound electric motor, it is peculiarly suited to starter work, and this type is used exclusively. Its most prominent feature and the one that is most valuable is that the torque increases with the load up to a certain limit. Obviously the motor must be wound to stand heavy overloads and must have quick acceleration. Withal it must be as light as possible and occupy the minimum space.

Broadly, electric lighting and engine starting systems can be divided into three general classes, as follows: (1) One unit in which the generator and starting motor are combined in a single machine (Fig. 4); (2) two units in which generator and motor are separately mounted (Fig. 5); (3) single unit, flywheel type, in which motor and generator are combined and the whole mounted with, or in place of, the engine flywheel (Figs. 3, 6 and 9).

Each type has its advantages. Thus, for instance, the two-unit type provides for nearly equal weight distribution of the elements and eliminates the possibility of the derangement of one disrupting the service of the other, though it makes necessary separate mounting and driving. The single unit type centralizes equipment, simplifies mounting and driving, but is open to the objection that both lighting and starting functions may be deranged through failure of either. The flywheel type does away with the necessity for gearing, but must be built into place at the factory of the car maker.

In two-unit outfits there are several ways in which the dynamo can be driven, the preferred method being through the valve gearing either by separate shaft and direct connection (Figs. 10, 11 and 12) or from the camshaft by "silent" chain. The characteristics of the machine largely determine the method, some machines requiring to be driven at comparatively high speed and some at crankshaft speed. Alternative methods are to gear the generator to the propeller shaft by chain or belt, or to drive it from the crankshaft by either chain or belt (Fig. 10). Obviously, where the generator and the starting motor are combined a drive more positive than that afforded by a belt must be provided.

The mounting and driving of the separate starting motor presents other difficulties, for it is plain that there must be some means of disconnecting it after it has performed its function. One of the simplest methods is to connect it to the engine through the intermediary of gearing cut in the periphery of the flywheel (Figs. 5 and 14). This method entails the necessity for a sliding pinion on the armature shaft and a means for engaging and disengaging it. Generally, the starting switch and the gear shifting mechanism are interconnected and a supplementary contact provided in the switch to rotate the armature shaft at low speed, first, to facilitate the engagement of the gears. Full depression of the starting lever engages the gears and throws the full current of the battery through the motor. When the engine starts, release of the lever disengages the gears, or else they are automatically "kicked" out of engagement when the peripheral speed of the flywheel exceeds the speed of the driving on the armature shaft.

In one starting motor (Fig. 5) the armature is movable longitudinally and the armature pinion is engaged with the flywheel gear through the solenoid action of the field on the armature when the current is thrown on; a spring disengages the gears. These methods apply, of course, only where the starting motor and generator are separate units.

Other methods include direct connection by shaft through the timing gear train with the interposition of an over-running clutch which lets go when the speed of the driven shaft exceeds that of the driving shaft; or a chain running over a sprocket on the crankshaft or on the propeller or clutch shafts (Fig. 4) may take the place of the shaft drive to the front gear train, the over-running clutch remaining as a matter of course. Latterly, some attempt has been made to incorporate the combined starting motor and generator in the transmission gearset, the connection being through integral, inclosed gearing. This method places the electric unit in a rather awkward position in so far as accessibility is concerned, and has not been largely adopted as yet.

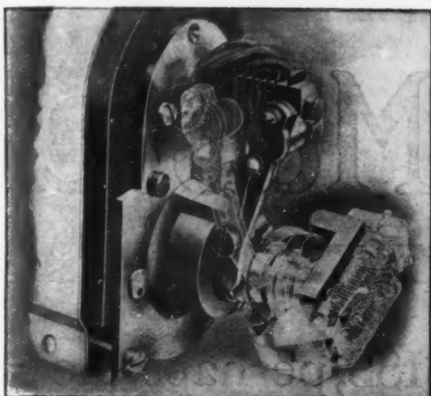
Where the motor and the generator form a single unit positive connection is essential. In this case, the unit is a motor when current is passed through it from the battery, but immediately the gasoline engine takes up its own cycle of operations and drives the motor, it automatically becomes a generator and charges the battery. Generally, an automatic cut-off (Fig. 8) to disconnect the battery from the generator when the engine is stopped is provided, though in one system none is provided. With this latter machine it is impossible for the gasoline engine to be stalled, for instantly the output of the generator drops below that of the battery—as when the engine stops—the generator becomes a motor and drives the gasoline engine. The connection between the electrical unit and the battery is manually made and broken.

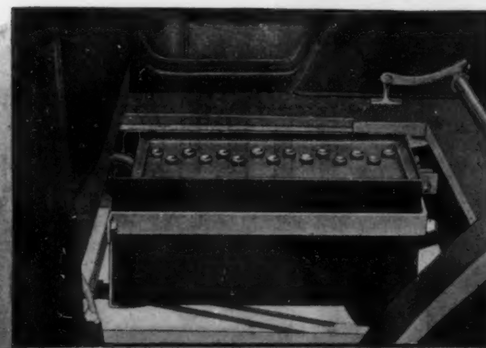
In conclusion, the electric engine starter undoubtedly is with us to stay. It has been perfected and refined and its operation rendered so automatic that not even a superficial knowledge of matters electrical is required properly to care for it. Just what the future will bring forth, no man can say. At present, manufacturers are bending their energies to increase efficiency by lightening apparatus, and in the not far distant future it is likely that we shall see all classes of cars electrically lighted and started, from the heaviest to the very lightest—not even excepting the so-called "cyclecar."

The Current Supplement

IN this week's issue of our Supplement Prof. Bateson discusses the subject of heredity with special reference to physical and mental taints.—Charles F. Fraasa, Jr., gives instructions for the construction of a fifty watt transformer.—Prof. Harker writes on the origin of solar electricity.—Dr. J. R. Williams gives us a study of the use of ice and other means of preserving food in the house.—Prof. H. L. Jameson writes on "Biological Science and the Pearling Industry."—The Hardening and Tempering of Steel is the subject of an illustrated article.—Alexander Gracie in his recent James Forrest lecture has brought forward many interesting data on present and past conditions and cost of ocean transport. The salient points of this lecture are summarized for our readers.

Capt. Amundsen, during his recent visit to Copenhagen, announced that he would sail from San Francisco on his north polar journey next June. His vessel, the "Fram," carries a crew of fourteen men, besides the leader and the scientific staff. Provisions for seven years will be taken, though Amundsen hopes to complete his undertaking in four. It is hoped to enter the ice drift in September. The equipment will include two aeroplanes, which Amundsen has bought in the United States. One of the staff recently took a course in aeronautics in France, and Amundsen will himself take a course before starting north. The Norwegian government has contributed 170,000 kroner ($45,560) toward the expedition.





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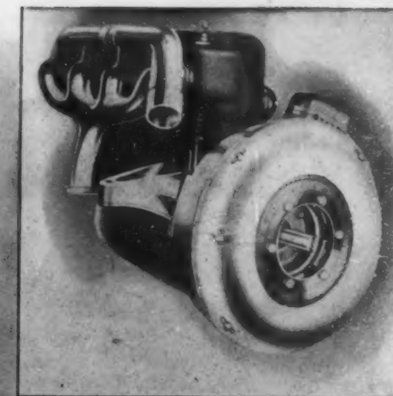

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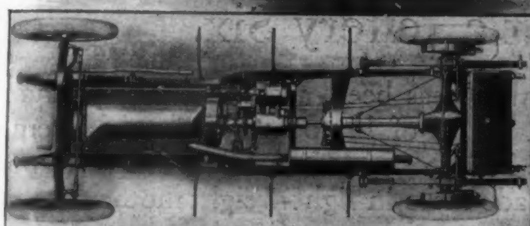

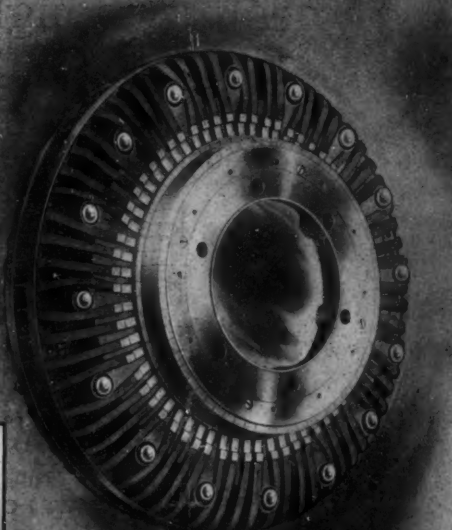

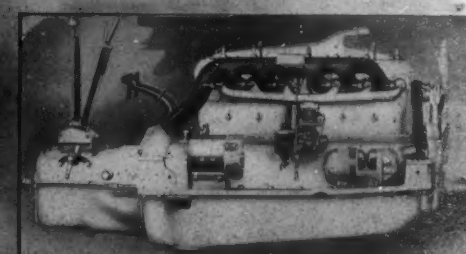

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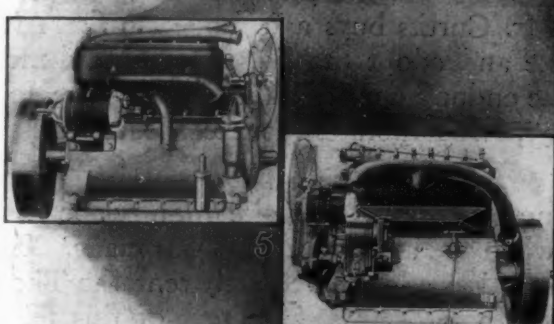

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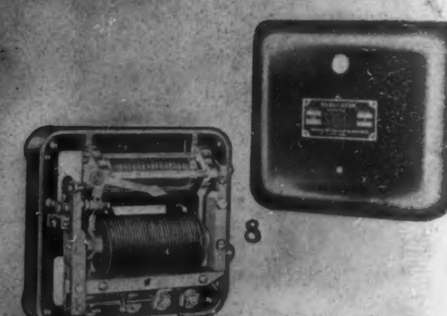

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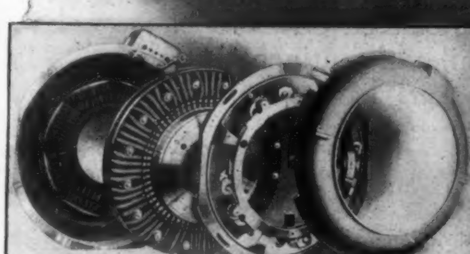

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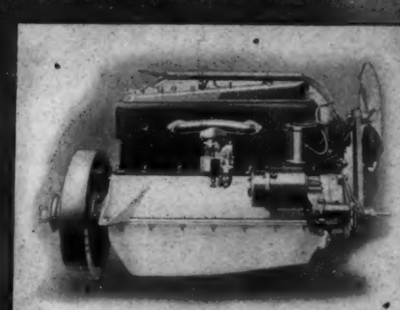

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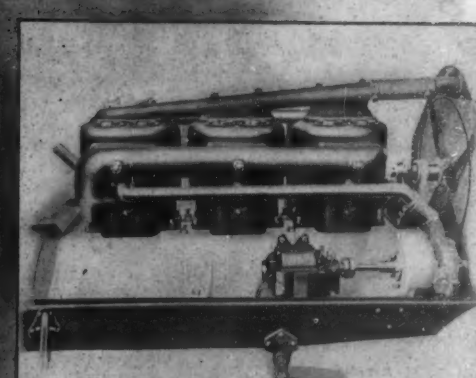

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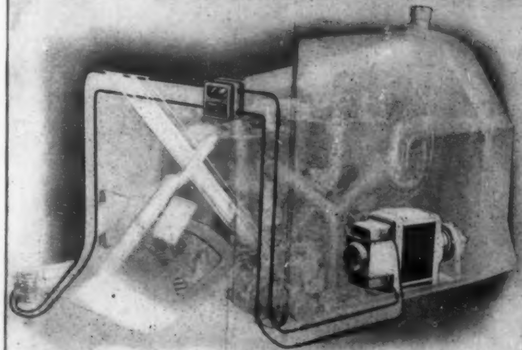

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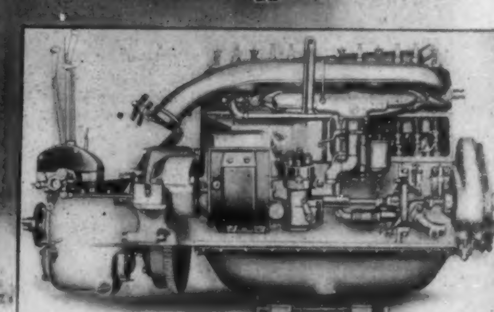

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Fig. 1.—*Generator Regulating Method.* A centrifugal device draws an arm over a series of contacts inserting resistance in the field as the speed of the armature is increased, thus maintaining the output practically constant. Fig. 2.—*Storage Battery Mounted Under Floor Boards.* Fig. 3.—*Flywheel Type Motor-generator in Place.* In this type of combined electric lighting and engine starting system the combined motor and generator takes the place of the usual engine flywheel. Fig. 4.—*Bottom View of Chassis Showing Installation of Starting Motor.* The motor is mounted adjacent to the transmission gearset and starts the engine through gears mounted on the clutch shaft. Fig. 5.—*A Typical Modern Electric Lighting and Starting Installation.* Right and left sides of motor showing generator mounting and drive through chain to the camshaft. The armature of the starting motor slides longitudinally, like the core of a solenoid, and engages its pinion with the flywheel gearing; a spring returns the armature to its normal position. Fig. 6.—*Armature of a Flywheel Motor Generator.* Fig. 7.—*Two-unit Lighting and Starting System Complete.* The generator is driven from the timing gear train and the starting motor is geared to the flywheel of the engine. Fig. 8.—*Combined Regulator and Cut-out.* A magnet, in series with the field windings, tends to separate the carbon disks, normally held together by a spring, as the output of the generator increases, thus increasing the resistance of the pile and lowering the output of the generator. The cut-out is an electro-magnetic device to disconnect battery and generator when the engine is stopped. Fig. 9.—*Flywheel Type Motor-generator Disassembled.* Reading from left to right the parts are as follows: Aluminium case with field coils; armature with commutator; brush carrier and brushes; aluminum dust ring. Fig. 10.—*Generator Driven by Chain from the Engine Crank Shaft.* Fig. 11.—*Installation of Generator Driven from Timing Gear Train.* Fig. 12.—*Generator Direct Connected to Timing Gears.* Fig. 13.—*Controller for Both Lighting and Starting Circuits.* Fig. 14.—*Mounting of Combined Lighting and Starting Unit.* As a generator the unit is driven through the pump shaft from the timing gear train; but as a motor, the unit drives the gasoline engine through the intermediary of gearing on the periphery of the flywheel. The operations are automatic.

NEW ELECTRIC STARTERS AND IGNITION DEVICES

...ece" says Glenn Curtiss

They had declared themselves for flexibility. Jeffery gave them a car that would make 40 miles an hour within 20 seconds, from a standing start.

They had declared themselves for lightness. Jeffery produced a car that weighs but 2870 pounds.

They had declared themselves for power. Jeffery offered a light, fast motor that develops 42 horsepower.

They asked economy. Jeffery motors are high efficiency motors; burning little gas; burning it completely, quickly and economically.

Jeffery lightness (2870) means a long life to tires; often six or eight thousand miles per set.

A Jeffery horsepower has to pull but 60 pounds of car—other motors have to pull from 80 to 100.

And above all, the discriminating buyer who has owned other cars, and had discovered the sacrifices necessary to low price, demanded comfort.

"It can't be done," said Jeffery dealers—

"It is impossible," said the owners whose specifications we set out to incorporate.

Jeffery did it.

And because he proved that we had met every demand for lightness, speed, power, economy and comfort, the result is mighty gratifying to us.

The best dealers everywhere in the country are organizing new companies and dropping other lines to sell this car, and the motor car buying public who have been paying much more for big, heavy, uneconomical cars, and much less for cheap, uncomfortable cars, are driving Jeffery cars this season.

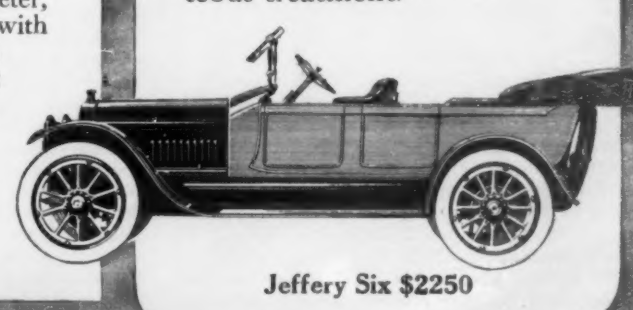
The Jeffery Six is a duplicate of the wonderful Jeffery Four, except for size. The cylinders are cast in pairs. This car, which sells at $2,250, is in a great many ways as remarkable among Sixes as its smaller brother is among the Fours. We built it for those who will drive nothing but a Jeffrey car, but who prefer a Six. It is light—actual scale weight, 3,570 pounds, with full equipment. We made it luxurious and beautiful without making it extravagant. We know that a better Six cannot be built.

The motor—3¾ x 5¼—develops 48 horsepower. The bearings are imported annular ball throughout. The ignition is Bosch Duplex and the starting and lighting system is the U-S-L of course. Wheel base, 128 inches, and wheels 36x4½—on enclosed cars 37x5—full floating rear axle. Rayfield carburetor, Warner autometer, ammeter, engine driven power tire pump, Rothschild body with extra wide doors and low, deep seats. This car is made with five-passenger touring or two-passenger roadster body at $2250; six-passenger at $2300; Sedan, five-passenger, $3250, and Limousine, at $3700.

The Thomas B. Jeffery Company
Main Office and Works, Kenosha, Wisconsin

Glenn Curtiss Says:

"I have been running the new Jeffery Six, and I am glad to report to you that the car is as good as it looks and a mechanical masterpiece. The machine is up-to-date in every respect and incorporates the latest European practice throughout. It has plenty of power and speed and is easy riding and very easy to handle. The engine is quiet and pulls exceptionally well on direct drive at slow speeds. I wish to thank you for your prompt delivery and courteous treatment."

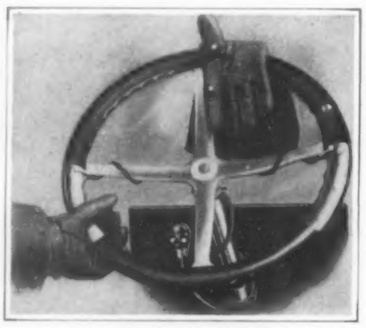


Jeffery Six $2250

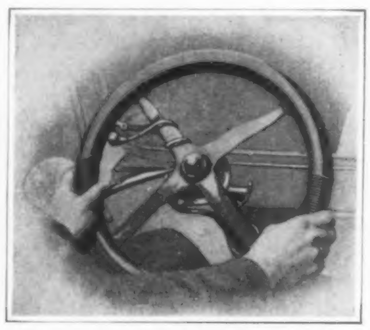
Making the Automobile Comfortable in Winter

By George Petman

IN at least one respect the motor world of to-day is vastly different from the motor world of yesterday. Whereas not more than a year or so ago the motorist who braved every summer storm, packed his car away —almost literally in moth balls—during the winter months when Jack Frost held sway, now drives the year around. It is a tendency that is becoming more and more marked each year. In a great many cases those who purchase cars when the new models come through in the fall or in the late summer, purchase two bodies to fit the one chassis—an open touring body for use during the remainder of the summer and a closed body, or either the limousine or landaulet or coupé type for use in the winter months. But even where two bodies are not purchased the all-year motorist is becoming ever more prominent, and there are abundant reasons why this should be so.



An electrically heated glove and heating units laced to wheel.



Electrically heated steering wheel wound with heating coils.

In the first place, the open car of a few years ago was an open one in very truth—it afforded little protection to those who occupied the tonneau seats and even less to the driver and his "left hand man." The day of the partly closed forward compartment had not yet dawned. To tour in winter then meant swathing one's self in layer upon layer of heavy robes until the *tout ensemble* presented more the appearance of a mummy than of anything else. And even when it was possible to prevent chills chasing themselves up and down one's back, real comfort still perched alluringly on the horizon.

With the advent of the closed front touring body, conditions were very much improved. Chill blasts from the sides were effectually stopped, and at least one layer of robes was rendered unnecessary. Later, manufacturers saw light in the deep scuttle dash that so long had been in vogue in England and on the Continent, and it slowly commenced to appear on American cars. Now, there scarcely is a car marketed that has not a scuttle dash, and certainly there are none that are minus front doors.

Strangely enough, however, little attention has been paid to the necessity for increasing the comfort of those who ride in the tônneau seats. Although the driver and the person who sits beside him may now ride in comparative comfort when the wintry winds do blow, those who ride in the tonneau still are constrained to disguise themselves with robes and furs. And this is all the more remarkable by reason of the fact that of the two seats, the tonneau seat is by far the colder. No doubt this is due in part to the fact that little or no heat from the engine penetrates to the back of the car. Another factor which undoubtedly contributes to the chill atmosphere that pervades the tonneau of most cars is that the windshield and the scuttle and the lines of the body tend to produce eddy currents which are swept over the front seats and down into the space between the back of the driver's seat and the back of the car.

As far as is known, no manufacturer thus far has made any provision for warming the tonneau of his car during cold weather, though manifestly there is a crying need for some device that will contribute to the comfort of passengers in the rear seats. A simple exhaust gas heater or a radiator receiving its warmth from the water in the engine jackets would serve the purpose excellently, and either method has the advantage that it is neither expensive to install nor to maintain. To warm the driver's compartment is considerably simpler than to warm the tonneau, of course, and this probably accounts for the greater attention that has been paid to the comfort of the driver. The simplest method of providing warmth is to insert a small grating in the floorboard and to provide it with a means whereby the openings can be varied to suit the temperature requirements of the driver. Heat generated by the engine then would be forced through the grating by the draft created by the cooling fan, and as exhaust products cannot escape beneath the engine hood no objection can be found to this method.

Devices of the kind tend to maintain only the lower extremities of the body at their normal temperature, of course, and as it is absolutely essential that the driver's hands be on the steering wheel during the whole of the time the vehicle is in motion, some other means of keeping his hands warm must be adopted. For this purpose there has been placed on the market an exhaust gas heated steering wheel, though it has not come into very great use owing to its complication, slight as it is in fact. Much preferred are the electrically heated steering wheels that are available. These devices operate on exactly the same principle as the ordinary electric heater except that being considerably smaller, they consume very much less current. In one type, the wheel complete is supplied by the maker and may be placed at the top of the steering post instead of the regular wheel. In another type, two grips containing the heating units lace to the existing wheel and therefore can be removed when not needed. Another device that only recently has come into fairly general use—as a matter of fact, all these devices are new—is the electrically heated glove a picture of which is reproduced herewith. The gloves contain the heating units coiled around inside the fingers and terminating in contacts so arranged that a natural grip on the steering wheel brings them against other contacts (on the wheel) connected with the source of energy which usually is the lighting storage battery. Thus, shifting the hands slightly disturbs the connection and permits the gloves to cool slightly in case their temperature becomes too high for comfort.

Electrically heated shoes—or overshoes—have yet to put in an appearance, though the necessity is not as great for the reason, already made plain, that sufficient heat to keep the driver's feet warm can be obtained from the engine. But to those who ride in the tonneau they would prove a boon indeed.

Lessening the Fuel Cost of Motors

By the Paris Correspondent of the Scientific American

SHOULD the comparatively valueless naphthalene come into general use for internal combustion motors, it will almost work a revolution in the cost of fuel in this most extensive field, so that the following account of recent tests made with the combustible in France should prove of interest. It is given by M. Ventou-Duclaux, a prominent member of the Automobile Club technical commission, and an authority on all such subjects. The tests were made upon a Renault motor car of the taxi-auto type, the motor having been transformed for the present use, it being a 12 horse-power 2 cylinder, 102 millimeters bore and 120 stroke. The special devices for naphthalene fuel were the result of two years study by Engineer G. Mohr, and they are shown in the illustrations.

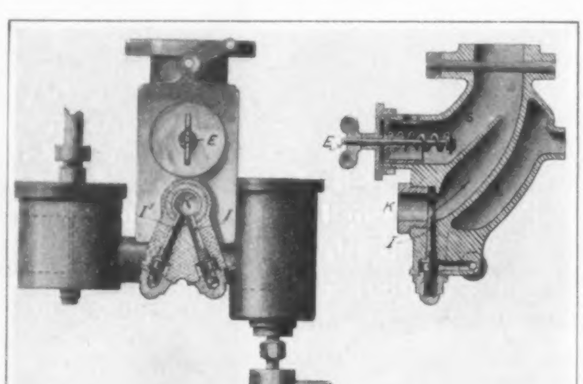


Fig. 1.—Section of a double carbureter for use of gasoline or naphthalene.

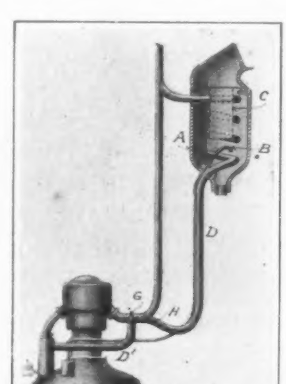


Fig. 2.—Apparatus for liquefying naphthalene.

The naphthalene is melted in a vessel heated by the exhaust gases of the motor (Fig. 2), and to this end the exhaust pipe is made up in a worm tube inside the vessel *A*. Inside is a filter *C* of wire gauze, into which the solid naphthalene is placed, thus retaining solid particles. When melted it runs down by the small tube *B*, which lies close to the hot exhaust pipe *D* so as to allow the naphthalene to reach the carbureter in the melted state. The carbureter is also kept hot by the exhaust gases by way of D^1 and the circulation of hot gases is regulated by the vanes *G* and *H*.

In Fig. 1 is seen the special carbureter, it being made double for the use of gasoline or naphthalene. On the left is the usual float-feed gasoline carbureter. The second one has also a float. The two spray nozzles *I* and I^1 work within a common chamber *K*, this chamber being placed between the jacket *L* having hot gas circulation and a second chamber *S* above, for extra air inlet. The naphthalene spray nozzle is seen at *I*, and air is drawn in for the mixture at *K*. Extra air is admitted in *S* by working the screw *E*.

The combustible used in this case is crude naphthalene whose price in the region of Paris is $1.20 per 100 kilogrammes (220.5 pounds). The following tests with the automobile were made under the direction of the Arts and Crafts Institution of Paris (Conservatoire des Arts et Metiers) and took place on the road between St. Germain and Vernon, on a distance of 52.7 kilometers (32.74 miles) each way, or a total of 105.4 kilometers (65.5 miles). The motor had been started up by gasoline a few minutes beforehand, so that the run could be made on the other fuel alone. The following results were obtained: Duration of test, 3 hours 19 minutes 30 seconds; stops (motor stopped), 15 minutes 30 seconds; net time of test, 3 hours 4 minutes; distance covered, 65.5 miles; state of road, good macadam route with average grades. Mean speed, 34.4 kilometers per hour (21.4 miles); highest speed taken (upon 1 kilometer: 0.62 mile), 42.3 kilometers per hour (26.3 miles); consumption of naphthalene, 14.906 kilogrammes (32.95 pounds).

From the above figures, the consumption of fuel is 14.228 kilogrammes (31.36 pounds) for 100 kilometers (62.1 miles). As regards working of the motor, the following favorable observations were made. At the beginning of the test the motor was started up without difficulty with naphthalene as fuel, after the use of gasoline in the cylinders. During the trial the motor ran regularly as usual and no failures or shocks were noted. After each stop, the motor could be started up easily without using gasoline. At the exhaust there is little or no smoke, except in the up-grades. On the next day it was found that the motor was clean inside and in good working shape, without deposits. It is specially noticed that there were no deposits of naphthalene in the crank-box. A second test was made to show the time needed to start up the motor. With the motor cold, it was started on gasoline, and after 13 minutes 37 seconds it could be run on the other fuel. At this time it was seen that the solid material in the chamber was not all melted. The motor was stopped during ten minutes and was then able to start upon naphthalene without difficulty. With a 16-minute stop it was required to use gasoline in order to start again.

The figures given show that the cost of fuel on a basis of 100 kilometers is: $14.228 \times 0.06 = 0.85$ franc (16.5 cents), or for 100 miles, $0.28. By adding the small amount of gasoline used, this can amount to 1.00 franc, or even less ($0.32 per 100 miles), while the same motor would have consumed 10 liters (2.64 gallons) of gasoline, representing a cost for 100 kilometers of 5 francs (or for 100 miles, $1.60). The difference between these figures will show the great economy realized. It is interesting to note that the *ensemble* of motor, carbureter and heating device does not reach more than 22 pounds per horse-power. The present tests allow of predicting other applications of the new fuel, such as for power wagons especially, and it may prove to be of great use in this field in cases where the power wagon is to transport material having a low value. For use in stationary engines it will also be available, and the cost for power will now be only 0.4 cent per horse-power hour. Fire risk will now be much less, for the gasoline tank is a very small one and besides can be removed when not in use for motor starting.

New Materials for Paper Making

WE are accustomed to regard paper as a thing of very little intrinsic value, and to treat it as one of the negligible details of business. For all that it is one of the most important and necessary articles of modern industry. The report of the Bureau of the Census places it as twenty-first on the list of manufactured products rated according to value. In the year 1909, the value of the paper and paper pulp manufactured in the United States was $267,657,000. This being the year 1913, the value is considerably greater.

Each year finds new uses to which this valuable material may be put, and hence each year the price of paper and of pulp rises. At present the chief source of pulp for the common grades of paper is the wood of certain pine, spruce and fir trees. The supply is limited, and the rate of consumption is increasing so rapidly that the entire supply is threatened with exhaustion in a few decades. Such is the ever-increasing demand for wood pulp that scientific men and inventors have been spurred on to search for substitutes for wood pulp. There can be no doubt that great pecuniary reward will be earned by the man who devises new processes and machinery which will make the paper manufacturer independent of the wood pulp supply.

A material suitable for the paper manufacturer's purpose must first of all yield a fiber that will "felt," in other words a fiber that will interlock and cohere in a homogeneous sheet. Many vegetable substances will meet this requirement, but a second and more practical consideration enters which is not so easily met. The substance must be such that the material from which the fiber is to be extracted may be readily broken up, so as to liberate the fibers. Moreover, the material must be available in sufficient quantity to make manufacture commercially successful. Lastly, the resultant product must be so cheap as to compete successfully with the paper made from wood pulp.

Numerous attempts have been made to employ the various vegetable by-products, such as sugar cane stalks, sugar beet pulp, etc. Until these products can be made into paper at a price of less than 3 cents a pound, there is no immediate hope of commercial success.

Before wood pulp was introduced about forty years ago, straw was largely used to furnish the fiber. But as it was possible to manufacture wood pulp paper at considerably less cost, this source of material was largely abandoned. However, it is quite possible that as soon as the price of wood pulp becomes so great as to make the manufacture of straw pulp profitable, the industry will be revived.

Prof. Reinke of Brunswick, Germany, has recently patented a process for obtaining cellulose from the refuse of tanning factories, especially pea and bean straw, and the straw and trimmings of asparagus. The trimmings, which constitute about 30 per cent of the weight of asparagus as it comes to the factory, decay very rapidly and have hitherto been used almost solely as a fertilizer, although they have been dried and employed as packing material to a small extent. A sort of wrapping paper made from them as an experiment, proved to be unsalable. Flavoring extracts are made from these trimmings, but Prof. Reinke's experiments have proved that the refuse of this industry can also be converted into cellulose. Still larger quantities of cellulose can be produced by heating asparagus straw or after-growth with sulphurous acid or soda lye in autoclaves, under four to six atmospheres pressure for from one hour to three hours. The cellulose is obtained in fiber of various lengths, and can be converted by grinding, washing, treating with permanganate, sulphurous acid, and the like, into material suitable for the production of paper, felt and other cellulose products.

A lucrative cellulose industry might be established by co-operation between growers and canners of asparagus. According to Prof. Reinke the factory trimmings yield 1.8 per cent of cellulose, amounting to about 15 pounds of cellulose per acre, while the asparagus straw (vines) yields 9 per cent, or about 174 pounds of cellulose per acre.

The production of cellulose from pea and bean straw is of great economic importance, because these materials have hitherto been almost worthless. Pea straw is used in small quantities as fodder, but it is usually plowed under. Bean straw is burned, and the ash has little value as fertilizer. Prof. Reinke has obtained cellulose of good quality by macerating both of these materials with lye under pressure. The process is similar to that employed from asparagus, but the product is superior both in quality and in quantity and is suitable for the manufacture of nitro-cellulose, viscose, etc., as well as for paper making. Pea straw yields 24 per cent, bean straw 33 per cent of cellulose, but this difference is more than compensated by the difference in the crop of straw per acre, so that one acre of peas yields 127 pounds, and an acre of beans 116 pounds of cellulose.

It has been proposed to use various weeds, grasses, cornstalks, sugar cane stalks, and many other vegetable matters, to furnish fiber. But in comparison with pulp wood, these materials are still commercially negligible. About forty-five to fifty per cent of the material of the wood can be made into a fiber paper. Ordinary straw yields about forty-five per cent, while cornstalks, grasses, etc., do not generally yield more than 25 per cent.

A recent report by Dr. Frederick Finch Strong on the manufacture of paper from a species of marsh grass, gives promise of a material that may become of commercial importance as the price of paper and wood pulp increases. The source of the fiber is a kind of marsh grass known as "big saw grass." This grows in immense quantities in the everglades of Florida. The largest patch extends over an area of about six hundred square miles. The stalks grow about four feet high, and the blades or leaves grow about an inch wide and up to about six feet in length. The leaf has a very sharp saw edge that cuts the flesh like a razor. It is possible to harvest two or three crops of this grass each year, and it would be very easy to obtain enough of the material to make commercial working successful. The method of preparing this grass for pulping differs from that used in making wood or straw pulp. The material is taken *green* and instead of being chemically digested, or ground, it is run through a mechanical digester that strips off the green outer covering and exposes the fibers. Soda or sulphite solution will not attack the green fleshy cover, but as soon as it is removed, the fiber bundles readily disintegrate into fibers under the action of a weak caustic solution and low pressure steam. The fiber that results can be made into a great variety of good papers.

At the February meeting of the London Society of Arts, Beadle and Stevens described Routledge's experiments in the utilization of bamboo fiber for paper making. Raith demonstrated in 1908 that unbleached bamboo pulp could be produced at a cost of about $30 a ton, one third of which sum is required for chemicals, as bamboo canes need a preliminary cleaning in order to enable the product to be bleached well. Beadle and Stevens also mentioned as exceedingly well adapted to paper making, the fibers of *Hedychium coronarium*, the "sweet snow" or "wreath flower," a plant which grows in India, Central and South America, and West Africa.

Another fiber-producing plant is a *Cryptostegia*, which is cultivated in the Bahama Islands and attains a height of 13 feet or more in one year. Excellent paper pulp closely resembling that obtained from rags is yielded by *Ponzolria hypolenca*, a plant which grows in German Southeast Africa, but is not cultivated, although it certainly could be grown with profit.

The success of Reinke's experiments with asparagus, pea and bean straw suggests the advisability of applying the same process to other material which is now of little or no value—for example, the fallen leaves of deciduous trees. The chlorophyl, carbohydrates and most of the mineral ingredients of the leaves are drawn back into the trunk before the leaves fall. The fallen leaves contain little else than cellulose, which has only slight value as a fertilizer. The toughness of the fibers is proved by the fact that the skeletons of the leaves do no decay until late in winter.

Recently a scheme was proposed in the handling of sugar cane that would allow of the extraction of the sugar, and the utilization of the fibers of the stalks. It was proposed to shred the cane on the plantations into a kind of coarse silage. This shredded material was then to be dried at the plantations, and shipped to the sugar mills, where the paper mill is also located. Here the sugar is to be extracted, and the stalk's material made into paper. But it is found that by the time the planter buys the coal to dry the cane, and pays the cost of transportation, he has paid out more than the fiber is worth. This process loses sight of the fact that cane stalks are used as fuel in sugar mills, thus saving the cost of any other fuel that would have to be employed in extracting the sugar.

A number of inventors have found ways of using the wood of the southern pine in making paper fibers. The wood of these trees is very resinous, and as a consequence the fibers are very hard to digest by the use of any of the well-known methods. By suitable treatment it is possible to break up this resinous binder, extract the pulp and save the resin. It is claimed by some inventors that the resins alone will pay for the cost of the extraction of the fibers, but for all that it seems that these processes cannot compete with the northern wood pulp processes.

A plant has been established in Louisiana to use sawmill shavings. A heavy wrapping paper is manufactured, and the plant saves the by-product of turpentine and resin.

One inventor, C. L. Weiberg (patent No. 1,025,435) has devised a process for utilizing the fibers from banana stems, tobacco, hemp, okra and seagrass, and several inventors have suggested processes for extracting fibers from peat. But the laws of economics are as inflexible as laws of nature, and until the price of the northern wood pulp rises to a higher figure than at present, these processes must wait for commercial development, serving meanwhile little more than reserve processes.

Wireless Telegraphy in the New York Fire Department

ALMOST simultaneously with the successful application of wireless telegraphy to moving trains for signalling and other purposes of communication, comes the announcement of its use in the fire alarm telegraph bureau of a great city with extensive water front and large shipping interests.

A successful test recently has been made of an installation at Fire Headquarters, New York city, whereby an operator at the central station of the telegraph bureau is able to maintain communication with a fleet of fireboats as they proceed about the waters of the harbor in answering an alarm, or when they are in actual service, as, for example, at a ship on fire at anchor. This new equipment involves a simple installation of wireless apparatus at Fire Headquarters in East Sixty-seventh Street, with an operator always on duty and a similar equipment on the fireboats which, so long as they remain at their station, are in touch with the telegraph bureau by the fire alarm telegraph and by telephone. As yet the equipment has been provided only for the large fireboat "James Duane," but it has worked so successfully and proved its utility that it doubtless will be extended to others of the fleet of ten fireboats which the city of New York maintains to protect its shipping and the water front.

The apparatus installed has an effective working range of about 25 miles, and is capable of being tuned to any wave length. Just as soon as the fireboat pulls out into the stream to answer an alarm, the operator on board goes to his instruments and establishes communication with headquarters. The fireboats, on account of their great pumping and hose capacity, respond to a large number of alarms from boxes on, or near, the water front, and in so doing make trips of considerable length. Many of these alarms are inconsequential, or even false, and the first land engine company to arrive often deals with the fire satisfactorily. As soon as the fire is put out, or the false alarm investigated, the officer in charge telegraphs the fact to fire headquarters and this may be within a very few minutes of sending the original alarm. With the new system, if there is no need for the services of a fireboat, the wireless operator at the central telegraph station transmits an order to the boat on its way and it returns to its station, thus obviating the useless journey with the consumption of coal, which is no small item, and also what is more important, the leaving of territory unprotected. This is indeed serious, as one or more fireboats may proceed a considerable distance in answering an alarm of no importance, while in their absence there may be an outbreak of fire where their services are needed. One or two occasions of this kind have occurred in New York within the last year so that the danger is more real than fancied.

At a recent demonstration at which a representative of the SCIENTIFIC AMERICAN was present, an alarm of fire from a box at Ninety-sixth Street and West End Avenue was turned in. That being a station at which the fireboat was due, the "James Duane" immediately got under way and proceeded out in the stream and up the Hudson River. Ten minutes later the wireless operator at headquarters, as if it had been a false alarm, sent out a message ordering the captain of the "James Duane" to return to quarters and a confirmation of the receipt of this order was immediately received. A few minutes later the commanding officer of the fireboat reported to headquarters over the ordinary telephone that his company had returned and that the messages had been received promptly and correctly.

In addition to the usefulness of wireless on the fireboats already suggested, the possibility of receiving wireless messages from ships at sea at fire headquarters and sending out assistance to vessels approaching the port with fires below their hatches, is also to be considered, as well as the summoning of assistance from ships at anchor where fire breaks out suddenly. As now even cargo steamers are generally provided with wireless equipment, it would be possible to summon assistance within a very few moments after a fire is discovered that the crew cannot cope with. Whether the usefulness of wireless on the fireboats protecting our large harbors may lead to their availability for deep sea service is, of course, problematical, but it will be seen that this new adjunct is not without possibilities in this direction.

Tobacco Growing in England.—The experiment of introducing the cultivation of tobacco in England is being carried out by an organization known as the Tobacco Growers' Society under the supervision of an expert from Rothamsted. The principal plantation is in Hampshire, where a large curing barn has been built. Ireland has now about 150 acres under tobacco, and small experiments of the same sort are under way in Scotland and Wales.

A Quick Reference Table for Commercial Motor Vehicle Buyers

A List of American Motor Trucks and Delivery Wagons Arranged According to Carrying Capacity

Compiled by C. Edward Palmer

A BUSINESS man buys a motor truck which, in his opinion, is best suited to handle his particular class of goods. Hence he is usually concerned more with tonnage than with price. In the commercial vehicle table printed on this page, truck manufacturers are, therefore, listed alphabetically with their products and their products are arranged according to tonnage.

Since the majority of gasoline trucks have four-cylinder motors, it has not been considered necessary to provide a separate column in which the number of cylinders is mentioned. Only the tonnage, horse-power and price are given. The most representative models of each manufacturer are listed and the prices, with very few exceptions, include the chassis only. Bodies in a great variety of forms are furnished by the manufacturers at prices ranging from $100 upward.

The majority of truck manufacturers are willing to sell to small merchants on easy payments and to supervise the installation of motor service.

GASOLINE COMMERCIAL VEHICLES

Name of Vehicle.	Name and Address of Manufacturer.	Tons Capacity, Horse-power and Price.						
		Under 1 ton.	1-1½.	2-2½.	3-3½.	4.	5.	6 and over.
A. & R.	Abendroth & Root Manufacturing Co., Newburgh, N. Y.				3, 36, $3,500.	4, 36, $3,700.	5, 53, $4,350.	
Adams	Adams Bros. Co., Findlay, O.		1, 30, $2,100.	2, 30, $2,500.				
Admiral	Admiral Motor Car Co., St. Louis, Mo.		1, 25, $1,475.					
A. I. C.	Ice Manufacturing Co., New York City						5, 29, $3,500.	
Alter	Cincinnati Motor Manufacturing Co., Cincinnati, O.	½, 33, $1,350						
Armieder	Armieder Co., Cincinnati, O.		1, 28, $2,200.	2½,34,$2,500				
Atterbury	Atterbury Motor Car Co., Buffalo, N. Y.	¾, 25, $1,500	1, 30, $2,000.	2, 40, $2,650.	3, 50, $3,350.		5, 50, $4,250.	
Autocar	The Autocar Co., Ardmore, Pa.		1½,18,$1,850					
Available	Available Truck Co., Chicago, Ill.		1, 28, $1,275.					
Avery	Avery Co., Peoria, Ill.		1½, 40 (Price	s on applicati	on)			
Barker	C. L. Barker, Norwalk, Conn.		1, 35, $2,000.					
Beck	Beck & Son, Cedar Rapids, Ia.		1½,40,$1,500		3, 50, $1,800.			
Best	Durant-Dort Carriage Co., Flint, Mich.	½, 13, $750.						
Bessemer	Bessemer Motor Truck Co., Grove City, Pa.	¾, 22, $1,250	1½,30,$2,100					
Blair	Blair Manufacturing Co., Newark, O.		1½,35,$2,850	2½,40,$3,250	3½,40,$3,750			
Brockway	Brockway Motor Truck Co., Cortland, N. Y.	½, 20, $900.	1½,30,$1,750					
Brown	Brown Commerical Car Co., Peru, Ind.	¾, 23, $1,650	1, 23, $1,850.					
Buick	Buick Motor Co., Flint, Mich.	½, 15, $1,000	1, 15, $1,125.					
Butler	Huselton Motor Co., Butler, Pa.	¾, 30, $1,650						
Casey	The F. A. Casey Co., Billerica, Mass.		1, 30, $1,650.	2½,40,$2,700		4, 40, $3,500.		
Chase	Chase Motor Truck Co., Syracuse, N. Y.	½, 34, $855.	1, 34, $1,200.	2, 40, $2,100.				
Coleman	Coleman Motor Truck Co., Ilion, N. Y.		1½,—,$1,950	2, —, $2,400.				
Commerce	Commerce Motor Car Co., Detroit, Mich.	½, 15, $875.						
Continental	Continental Truck Manufacturing Co., Superior, Wis.		1½,35,$1,500					
Corbitt	Corbitt Automobile Co., Henderson, N. C.		1¼,23,$2,000					
Couple-Gear	Couple-Gear Wheel Co., Grand Rapids, Mich.				3½,24,$4,250	(4 wheel drive	)5,36, $4,850(	4 wheel drive)
Crow Elk-Hart	Crow Motor Car Co., Elkhart, Ind.	¾, 33, $950.						
Crown	Crown Commercial Car Co., Milwaukee, Wis.	¾, 26, $1,350	1, 32, $2,300.	2, 35, $2,800.	3, 40, $3,300.	4, 45, $4,000.		6, 50, $4,500.
Danielson	Danielson Engine Works, Chicago, Ill.		1½,28,$2,000				5, 45, $4,500.	
Dart	Dart Manufacturing Co., Waterloo, Ia.	½, 20, $715.	1, 30, $1,300.	2, 40, $1,775.				
Dayton	Dayton Automobile Truck Co., Dayton, O.		1, 25, $1,500.	2, 30, $2,650.	3, 30, $3,400.	4, 40, $3,900.	5, 40, $4,500.	7, 65, $5,600.
Day Utility	Day Automobile Co., Detroit, Mich.	—, 33, $1,500	(Combinatio	n body)				
Dispatch	Dispatch Motor Car Co., Minneapolis, Minn.	½, 23, $800.						
Dorris	Dorris Motor Car Co., St. Louis, Mo.	¾, 45, $2,100		2, 45, $2,500.	3, 45,			
Duplex	Duplex Power Car Co., Charlotte, Mich.			2, 26, $2,400.				
Duryea	Duryea Motor Co., Saginaw, Mich.	½, 23 $600.						
Evans	Evans Limited Commercial Car Co., Nashville, Tenn.		1, 30, $1,000.					
Federal	Federal Motor Truck Co., Detroit, Mich.		1½,30,$1,800					
Flint	Durant-Dort Carriage Co., Flint, Mich.	¾, 22, $1,375						
Four Wheel Drive	Four Wheel Drive Automobile Co., Clintonville, Wis.		1½,29,$3,600		3, 36, $4,000.			
Gabriel	Gabriel Automobile Co., Cleveland, O.	½, 22, $900.	1, 35, $2,000.					
Garford	The Garford Co., Elyria, O.			2, 29, $2,800.	3, 29, $3,500.		5, 29, $4,500.	
Gay	S. G. Gay Co., Ottawa, Ill.	¾, 25, $1,500	1, 25, $1,500.					
G. M. C.	General Motors Truck Co., Pontiac, Mich.		1¼ 20, $1,900	2, 25, $2,600.	3½,40,$3,500		5, 40, $4,500.	
Gramm	Gramm-Bernstein Co., Lima, O.		1, 30, $1,750.	2, 45, $2,750.	3½,45,$3,600		5, 60, $4,500.	
Harvey	Harvey Motor Truck Works, Harvey, Ill.		1½,23,$1,875					
Hatfield	Hatfield Automobile Truck Co., Elmira, N. Y.	½, 18, $850.	1, 20, $1,200.					
Hewitt-Ludlow	Hewitt-Ludlow Automobile Co., San Francisco, Cal.		1½,30,$2,250					
Horner	Detroit-Wyandotte Motor Co., Wyandotte, Mich.	2/5, 17, $975.	1, 24, $2,000.	2, 27, $2,650.	3, 32, $3,200.		5, 44, $4,200.	
Hupmobile	Hupp Motor Car Co., Detroit, Mich.							
Ideal	Ideal Automobile Co., Fort Wayne, Ind.		1, 30, $1,500.	2½,45,$2,500				
International	International Harvester Co., Chicago, Ill.	½, 20 (Prices	on applicatio	n)				
Juno	Juno Motor Truck Co., Juneau, Wis.			2, 35, $2,800.	3, 45, $3,400.			
Jeffery	Thomas B. Jeffery Co., Kenosha, Wis.	¾, 38, $1,250	1, 38, $1,500.					
Kalamazoo	Kalamazoo Motor Vehicle Co., Kalamazoo, Mich.		1½,30,$1,700					
Kearns	Kearns Motor Truck Co., Beavertown, Pa.	¾, 23, $850.						
Kelly	Kelly-Springfield Motor Truck Co., Springfield, O.		1½,25,$2,000		3, 39, $3,400.	4, 39, $3,500		
King	A. R. King Manufacturing Co., Kingston, N. Y.				3½,45,$3,350			
Kissel Kar	Kissel Motor Car Co., Hartford, Wis.	¾, 36, $1,500	1, 38, $1,850.	2½,38, 2,750	3½, ... 3,350			6, ... $4,500.
Knox	Knox Automobile Co., Springfield, Mass.			2, 40, $3,000.				8, 40, $3,200.
Koehler	H. J. Koehler S. G. Co., New York city		1, 24, $725.					
Kosmoth	The Kosmoth Co., Detroit, Mich.	½, 20, $630.						
Krebs	Krebs Commercial Car Co., Clyde, O.		1½,23,$1,775					
Krit	Krit Motor Car Co., Detroit, Mich.	½, 28, $900.						
Landshaft	William Landshaft & Son, Chicago, Ill.	¾, 20, $1,000	1, 28, $1,450.	2, 35, $2,250.	3, 45, $2,750.		5, 45, $3,250.	
Lange	Lange Motor Truck Co., Pittsburgh, Pa.		1, 30, $2,250.	2, 35, $3,000.				
Lauth-Juergens	Lauth-Juergens Motor Car Co., Fremont, O.		1, 30, $2,100.	2, 30, $2,800.	3, 40, $3,450.		5, 50, $4,500.	
Lewis	Lewis Motor Truck Co., San Francisco, Cal.			2½,40,$3,250	3, 40, $3,500.		5, 50, $4,750.	
Lippard-Stewart	Lippard-Stewart Motor Car Co., Buffalo, N. Y.	¾, 30, $1,650	1½,35,$2,300					
Luck Truck	Cleburne Motor Car Co., Cleburne, Texas	½, 25, $800.						
Light	Light Commercial Car Co., New York City	½, 10, $475.						
Little Giant	Chicago Pneumatic Tool Co., Chicago, Ill.		1, 25, $1,350.					
Locomobile	Locomobile Company of America, Bridgeport, Conn.						5, 40, $4,800.	
Longest	Longest Bros. Co., Louisville, Ky.				3, 40, $4,000.		5, 40, $4,500.	
Mack	International Motor Co., New York City		1, 32, $2,000.	2, 32, $2,700.	3, 48, $3,400.		5, 48, $4,000.	7½,48,$5,000
Mais	Mais Motor Truck Co., Indianapolis, Ind.		1½,—,$2,750	2½,—,$3,200	3, —, $3,400.			
Mansur	Mansur Motor Truck Co., Haverhill, Mass.		1½,30,$2,400					
Marmon	Nordyke & Marmon Co., Indianapolis, Ind.	¾, 30, $2,500						
Martin	Martin Carriage Works, York, Pa.		1½,35, ...	2, 40,		4, 55 (Prices	on applicatio	n)
Mason	Mason Motor Co., Waterloo, Ia.	¾, 28, $800.						
McIntyre	W. H. McIntyre Co., Auburn, Ind.	½, ... $800.	1½, ... $2,300		3, ... $3,200.			
Menominee	D. F. Poyer Co., Menominee, Mich.	¾, 25, $1,125	1½,35,$1,800					
Messinger	Messinger Manufacturing Co., Tatamy, Pa.			2, 30, $2,400.				
Miller	Miller Car Co., Detroit, Mich.	½, 22, $850.						
Modern	Bowling Green Motor Car Co., Bowling Green, O.	¾, 25, $1,500	1, 30, $1,700					
Moeller	New Haven Truck and Automobile Works, New Haven, Conn.		1½,30,$2,500		3, 35, $3,400.		5, 45, $4,500.	
Mogul	Mogul Motor Truck Co., St. Louis, Mo.			2, 35, $2,360.			5, 50, $4,300.	6, 60, $4,600.
Moon	Jas. W. Moon Buggy Co., St. Louis, Mo.	½, 28, $1,350	1½,30,$1,800					
Moore	Pacific Metal Products Co., Torrence, Cal.		1½,35,$1,975	2, 45, $2,500.	3, 45, $3,150.	4, 55, $3,500.	5, 65, $4,500.	6, 65, $4,900.
Mora	Mora Power Wagon Co., Cleveland, O.		1, 25, $1,400.					
Moreland	Moreland Motor Truck Co., Los Angeles, Cal.	¾, 30, $1,700	1¼,32,$1,980	2, 40, $2,350.	3, 58, $3,150.	4, 65, $3,500.	5, 80, $4,500.	
Natco	National Motor Truck Co., Bay City, Mich.		1, 20, $1,925.					
Nelson	Nelson & LeMoon, Chicago, Ill.		1, 30, $1,800	2, 35, $2,250.	3, 40, $2,750.			
New York	Tegetmeier & Riepe Co., New York City		1¼,30,$2,100					
Neustadt	E. L. Epperson Commercial Truck Co., St. Louis, Mo.		1, 26, $1,000.	2, 35, $1,250.				
Old Reliable	Old Reliable Motor Truck Co., Chicago, Ill.			2, 35, $2,750.		4, 45, $4,000.	5, 45, $4,500.	
Packard	Packard Motor Car Co., Detroit, Mich.			2, 28, $2,900.	3, 32, $3,500.	4, 32, $3,550.	5, 40, $4,600.	6, 40, $4,650.
Palmer	Palmer-Meyer Motor Car Co., St. Louis, Mo.		1, 30, $1,600.	2, 35, $2,000.				
Palmer-Moore	Palmer-Moore Co., Syracuse, N. Y.		1, 20, $1,350					
Perfex	The Perfex Co., Los Angeles, Cal.	½, 16, $900.						
Peerless	Peerless Motor Car Co., Cleveland, O.				3, 32, $3,700.	4, 32, $4,000.	5, 32, $4,500.	6, 32, ...
Pierce-Arrow	Pierce-Arrow Motor Car Co., Buffalo, N. Y.			2, 26, $3,000.			5, 38, $4,500.	
Pope-Hartford	Pope Manufacturing Company, Hartford, Conn.				3, 50, $3,350.		5 50, $4,350.	
Progress	Universal Machine Co., Milwaukee, Wis.		1½,32,$2,250		3, 45, $3,500.			
Republic	Alma Motor Truck Co., Alma, Mich.		1, 30, $1,350.					
Robinson	Robinson Motor Truck Co., Minneapolis, Minn.		1½,30,$2,200	2, 35, $2,500.	3, 40, $3,200.	4, 45, $3,500.	5, 50, $3,800.	
Rockford	Rockford Motor Truck Co., Rockford, Ill.	¾, 25, $1,500		2, 35, $2,500.				
S. & S.	Sayers & Scovill Co., Cincinnati, O.		35, $1,850 (A	mbulance and	Hearse bodie	s)		
Sandusky	Sandusky Automobile Parts and Motor Truck Co., Sandusky, O.	¾, 25, $1,400	1½,25,$1,900					
Sanford	Sanford Motor Truck Co., Syracuse, N. Y.		1, 26, $1,660.					
Saurer	International Motor Co., New York City						5, 31, $4,800.	6½,31,$5,800
Service	Service Motor Car Co., Wabash, Ind.		1½,40,$1,800	2, 40, $2,375.	3, 45, $2,975.			
Schacht	G. A. Schacht Motor Truck Co., Cincinnati, O.			2, 29, $2,650.				
Smith	A. O. Smith Co., Milwaukee, Wis.				3½,40,$3,750			6, 50, $4,750.
Speedwell	Speedwell Motor Car Co., Dayton, O.			2, 27, $2,850.		4, 40, $3,750.		6, 40, $4,400.
Standard	Standard Motor Truck Co., Detroit, Mich.				3, 32, $2,850.			
Star	Star Motor Car Co., Ann Arbor, Mich.	¾, 30, $1,500	1½,35,$1,800					
Stearns	F. B. Stearns Co., Cleveland, O.						5, 36, $3,800.	
Stegeman	Stegeman Motor Car Co., Milwaukee, Wis.	¾, 30, $1,600	1, 30, $2,250.	2, 35, $2,950.	3, 45, $3,500.	4, 45, $3,950.		
Sternberg	Sternberg Manufacturing Co., Milwaukee, Wis.			2, 29, $2,800.	3, 29, $3,400.	4, 32, $4,000.	5, 32, $4,500.	7, 32, $5,000.
Stewart	Stewart Motor Corporation, Buffalo, N. Y.	¾, 30, $1,500						
Stewart	Stewart Iron Works, Cincinnati, O.		1, 20, $1,150.					
Studebaker	Studebaker Corporation of America, Detroit, Mich.	¾, 35, $1,050						
Sullivan	Sullivan Motor Car Co., Rochester, N. Y.	½, 18, $925.	1, 18, $1,050.					
Tiffin	Tiffin Wagon Co., Tiffin, O.	3/5, 25, $1,600	1, 30, $2,000.	2, 35, $2,600.				
Transit	Transit Motor Truck Co., Louisville, Ky.		1, 23, $2,000.	2, 27, $2,850.	3½,32,$3,500		5, 32, $4,500.	

A Quick Reference Table for Commercial Motor Vehicle Buyers—Concluded

Name of Vehicle.	Name and Address of Manufacturer.	Tons Capacity, Horse-power and Price.						
		Under 1 ton.	1-1½.	2-2½.	3-3½.	4.	5.	6 and over.
Trojan	Toledo Carriage Co., Toledo, O.	¾, —, $1,500						
Tulsa	Tulsa Automobile Manufacturing Co., Tulsa, Okla.	¾, 42, $1,350						
U. S.	United States Motor Truck Co., Cincinnati, O.			2, 27, $2,800.	3, 32, $3,500.			
Universal	Universal Motor Truck Co., Detroit, Mich.		1½, 23, $1,950		3, 25, $3,400.			
Van Winkle	Van Winkle Motor Truck Co., Atlanta, Ga.		1½, 30, $2,250	2½, 30, $2,800	3½, 45, $3,500			
Veerac	Veerac Motor Co., Anoka, Minn.	¾, 20, $925.						
Velie	Velie Motor Vehicle Co., Moline, Ill.	¾, 32, $1,600		2, 32, $2,850.	3, 32, $3,350.			
Vulcan	Driggs-Seabury Ord. Corp., Sharon, Pa.			2, 26, $2,750.	3, 26, $3,250.	4, 30, $4,000.	5, 30, $4,500.	7, 36, $6,000.
Wade	Wade Commercial Car Co., Holly, Mich.	2/5, 8, $375.						
Wagenhals	Wagenhals Motor Co., Detroit, Mich.	2/5, 20, $690.						
Ware	Ware Motor Vehicle Co., St. Paul, Minn.			2, 40, $3,000	(4 wheel driv	e)		
Wichita	Wichita Falls Motor Co., Wichita Falls, Texas		1, 30, $1,650.	2, 35, $2,100.	3½, 50, $3,250			
White	The White Co., Cleveland, O.	¾, 23, $2,100	1½, 23, $3,000		3, 23, $3,700.		5, 23, $4,500.	
White Star	White Star Motor Co., Brooklyn, N. Y.		1, 30, $2,000.	2, 35, $2,750	3, 40, $3,400.	4, 45, $3,700.	5, 45, $4,200.	
Wilcox	H. E. Wilcox Motor Car Co., Minneapolis, Minn.		1, 27	2, 29	3, 29	(Prices on ap	plication)	
Willt	Willt Engine and Truck Co., Buffalo, N. Y	¾, 23, $1,650		2, 32, $2,800.				
Willys-Utility	Gramm Motor Truck Co., Lima, O	¾, 27, $1,250						
Witt-Will	Witt-Will Co., Washington, D. C		1, 35	2, 42		4, 50	(Prices on ap	plication)

Since the majority of the gasoline commercial vehicles have 4-cylinder motors, this figure has been omitted from the above table. The first figure in each case represents the tons capacity, the second figure the horse-power, and the third the price. Only the most representative models of each manufacturer are listed. The prices for the most part for the chassis only. Bodies are usually made to order.

Electric Commercial Vehicles

As in the Gasoline Commercial Vehicle list, the prices are almost invariably for the chassis only. Bodies are built to order.

Name of Vehicle.	Name and Address of Manufacturer.	Tons Capacity, Horse-power and Price.						
		Under 1 Ton.	1-1½.	2-2½.	3-3½.	4.	5.	6 and over.
Argo	Argo Electric Vehicle Co., Saginaw, Mich.	½, $1,900.	1, $2,150.					
Atlantic	Atlantic Vehicle Co., New York City	½, $1,960.	1, $2,200.	2, $2,750.	3½, $3,375.		5, $3,825.	
Baker	Baker Motor Vehicle Co., Cleveland, O.	½, $1,900.	1, $2,300.	2, $2,800.	3½, $3,500.			
Borland	Borland-Grannis Co., Chicago, Ill.	¾, $2,100.						
Buffalo	Buffalo Electric Vehicle Co., Buffalo, N. Y.		1, $2,400.					
Capitol	Capitol Truck Manufacturing Co., Denver, Colo.	½, $1,800.						
Couple Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich.				3, $3,650.		5, $4,150 (Front	wheel drive).
Couple Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich.				3½, $4,400.		5, $5,000 (Four	wheel drive).
C. T.	Commercial Truck Company of America, Philadelphia, Pa.	½, $1,940.	1, $2,345.	2, $3,050.	3½, $3,880.		5, $4,310.	
Dayton	Dayton Electric Car Co., Dayton, O.	½, $1,400.						
Detroit	Anderson Electric Car Co., Detroit, Mich.	½, $2,350.	1, $2,800.	2, $3,750.	3, $5,000.		5, $5,500.	
Eldridge	Eldridge Manufacturing Co., Boston, Mass.			2,	3,		5,	7, 10, *
G. M. C.	General Motors Truck Co., Pontiac, Mich.	½, $1,400.	1, $1,500.	2, $2,000.	3, $2,300.	4, $2,650.	5, $2,950.	6, $3,200.
G. V. Electric	General Vehicle Co., Long Island City	½, $1,700.	1, $2,100.	2, $2,600.	3½, $3,250.		5, $3,700.	
Urban	Kentucky Wagon Manufacturing Co., Louisville, Ky.	½,	1,	2,	3½,	(Prices on appli	cation)	
Victor	M. & P. Electric Vehicle Co., Detroit, Mich.	½, $1,550.	1, $2,100.					
Walker	Walker Vehicle Co., Chicago, Ill.	½,	1, 1½,	2½,	3½,	(Prices on appli	cation)	
Ward	Ward Motor Vehicle Co., New York City	¾, $1,450.	1¼, $1,900.	2½, $2,400.			5, $2,950.	
Waverley	The Waverley Co., Indianapolis, Ind.	½, $2,000.	1, $2,400.	2, $3,250.	3½, $3,750.		5, $4,500.	

* Front wheel drive.

Scarcity of True Box Wood

IN the literature of the commercial woods of the world the word "box" appears frequently, applied oftentimes to woods that are widely distinct from each other. The word is usually employed with a prefix, even when the true box wood is meant, as Persian box, Russian box, Himalayan box, etc. In this article will be considered the wood of the box tree proper, the *Buxus sempervirens* of the botanists, which has been so generally imported into the United States and England as wood for the engraver's use. The German name of this tree is buxbaum; in French it is called buis; the Italian name is bosso, from which doubtless, its Latin name, *Buxus*, is derived; and in Persia it is known as Shanda laghune.

Its native home is Persia and the territory surrounding the Black and Caspian Seas, but it is in general cultivation in many parts of the world, and grows successfully as far north as 52 degrees latitude. While it grows in the temperate and more tropical climates, it is only for export in southern Europe and in parts of southern Asia. It is at present derived mainly from the forests of the Caucasus, Armenia, and the Caspian shores. The wood of the best qualities comes from the Baltic Sea forests and is shipped largely from the port of Poti. It is grown also in all parts of India, and in many districts flourishes in a wild state. It is but little planted and protected for its wood, but is largely grown and highly esteemed in Europe for ornamental and other useful purposes. To the gardener the box is a well-known, hardy evergreen tree or shrub, which seldom exceeds the height of from 12 to 15 feet in the United States, but in Turkey and Asia Minor it is sometimes found as high as 25 feet. The thickness of the trunk is often out of proportion to the height of the tree, because in full grown trees it varies from 6 to 9 inches in diameter near the ground.

Box wood is remarkably heavy (about 70 pounds per cubic foot), very hard, fine and straight-grained, takes a very high polish, and has a light yellow color. It is very liable to check in drying, and in order to prevent this the wood is placed in a dark cellar for from three to five years. At the end of this time the sapwood is removed with a hatchet and the heartwood again placed in a dark cool cellar or barn until wanted. For the best result the wood should be boiled for some time, and after it is dry, buried in dry sand until required.

The box wood has been in great demand already by the Greeks and Romans, and Theophrastus classed it with that of ebony on account of its usefulness and very fine grain. Pliny described box wood and said that it is as hard to burn as iron, and observed that it is totally unfit for charcoal. Both Virgil and Ovid stated that the wood was used very early for making musical instruments. With the advance of civilization box wood came into use for wood carving, and for this purpose it soon formed an important article of trade. It was also used extensively in England very early in cabinet making and inlaying, turnery, and a multitude of other purposes.

The use of box wood has been so very great that it is becoming scarce and consequently very costly. It is now so valuable that the trees are dug up by their roots and the latter are used for various articles of turnery. The root wood is very beautifully marbled or veined and the articles manufactured from it vary in value accordingly. The tree grows exceedingly slow, and the rate of consumption is far greater than the growth. No wood has yet been found to take the place of box for engraving, and for this the demand is great and the supply is limited. The want of the present day is a suitable substitute.

Mechanical Management

SO much has been said of late about scientific management in manufacturing establishments that it may be desirable to look ahead a little and endeavor to see just what departments of productive activity are really in line to be managed according to the methods thus advocated. In general, it seems as if the lines of work capable of such organization and conduct are those from which, in the course of a comparatively short time, the skilled mechanic may be almost wholly eliminated.

Repetitive processes, operations which may be described in instruction cards or planned out wholly in advance by some one other than the individual by whom they are to be executed, are the very ones from which the element of individual judgment may be almost entirely removed, and therefore are next in line to be turned over to an inanimate and almost entirely automatic machine. The things which the machine cannot do to advantage are those which are not performed twice alike, and into which the immediate and varying judgment of the man who is really doing the work must enter. Such work is becoming of less and less importance from the commercial point of view, and the real mechanic, according to the old-time standard, is almost to be classed with the artist, the man into whose work his own personality enters so largely as to make it impracticable for him to tell any-one else how to do it as well.

When a piece of work demands the private judgment of the operator to any material extent, it is hardly adaptable to any system of intensified production, such as is desirable for the methods of modern scientific management.

It follows that one of the important things in connection with the introduction of such a plan lies in the systematization of the product itself, to render its manufacture practicable under the new conditions. If, however, such a study is given to the repetitive character of the product, it will be found, in nearly every instance, to lead to the introduction of such mechanical methods as to take practically all discretion out of the hands of the operative and convert him into a machine tender, his speed being determined by that of the machinery with which he is associated, and he himself becoming practically a part of those machines.

Such a condition of affairs has already been reached in some departments of industry, and there is every reason to believe that it will be extended. Its growth means a change in industrial conditions which will well bear examining, and it seems as if the present interest in scientific management is really only an intermediate and passing stage in a far deeper transformation in manufacturing conditions.

The kind of work which, if done by men, must be done in a mechanical manner, is the kind of work which should not be done by men at all; and it is for the advancement of the race to have it taken out of the hands of human beings and transferred to inanimate mechanism. This means that men must be given a higher and better kind of work to do, work which involves the use of their heads as well as their hands, and the men who have hitherto performed purely mechanical work qualify for the newer and higher class of activity. The Suez Canal was dug with human hands and wicker baskets; the Panama Canal is being excavated by the steam shovel, the hydraulic jet, and the dump car, under the guidance of men of intelligence and judgment.

When, therefore, any department of industry is studied with a view to the introduction of scientific management, it is suggested that the study be carried on to the next stage of technical progress without lingering at the transitory phase, and that a direct effort be made to arrange the product and the processes in such a manner as to permit the employment of a limited number of highly intelligent directors, and of such a number of machine tenders as may be necessary, relegating everything which can possibly be performed in a purely mechanical manner to a machine and not to a man.—*Cassier's Magazine.*

Preventing Mold on Books.—An effective way to prevent books from becoming musty and possibly moldy in moist weather is to place a few drops of oil of lavender and Canadian balsam in a back corner of each shelf. This will not injure the bindings of leather books as sulphur compounds do, but helps preserve the bindings. The two substances are easily obtained.

A Price List and Table of 1914 American Gasoline Pleasure Cars

A Ready Reference Table for the Prospective Automobile Purchaser

Compiled by C. Edward Palmer

THE composite price list of pleasure cars published in the Scientific American *Automobile Number of 1913 received such favorable comment at the time that it has been decided this year to publish a list on a much broader scale. Such lists are of great benefit to those who visit motor shows with the intention of buying a car. Every prospective automobile buyer must answer the old question: "What Cars Are Within My Price?" It is chiefly for the benefit of such prospective buyers that the compact information here presented has been prepared.*

The following table is self-explanatory except for the abbreviations used. In the fourth column the first figure indicates the number of cylinders; the second gives the rated horse-power. The letters refer to the type of body used on that particular chassis. Thus, r, *means roadster;* t, *means touring car;* l, *limousine;* c, *coupé;* ld, *landaulet;* p, *phaeton;* b, *berline;* s, *sedan.*

The table does not pretend to be absolutely complete. It does not include manufacturers whose output amounts only to a very few number of cars each year; nor does it include every car turned out by the manufacturers listed. Wherever further information as to other types is desired the manufacturers will furnish complete details, catalogues, and specifications on request.

Price.	Name of Car.	Name and Address of Manufacturer.	No. of Cylinders. Horse-power and Body Type.
$450	Duryea	Duryea Motor Co., Saginaw, Mich	2, 14, *buggy.*
475	Metz	Metz Co., Waltham, Mass	4, 22, *r.*
495	Grant	Grant Motor Co., Detroit, Mich	4, 21, *r.*
500	Ford	Ford Motor Co., Detroit, Mich	4, 20, *r.*
550	Ford	Ford Motor Co., Detroit, Mich	4, 20, *t.*
650	Duryea	Duryea Motor Co., Saginaw, Mich	2, 14, *r.*
750	Chevrolet	Chevrolet Motor Co., Flint, Mich	4, 24, *r.*
750	Comet	Continental Motors Corpn., Buffalo, N. Y	4, 25, *r.*
750	Ford	Ford Motor Co., Detroit, Mich	4, 20, *c.*
750	Maxwell	Maxwell M. C. C., Detroit, Mich	4, 25, *t.*
750	Oriole	Columbia Electric Co., Knightstown, Ind	4, 20, *r.*
750	Vulcan	Vulcan Mfg. Co., Painesville, O	4, 27, *r.*
850	Detroiter	Briggs-Detroiter Co., Detroit, Mich	4, 25, *t.*
850	Read	Read M. C. Co., Detroit, Mich	4, 33, *t.*
850	Vulcan	Vulcan Mfg. Co., Painesville, O	4, 27, *t.*
875	Chevrolet	Chevrolet Motor Co., Flint, Mich	4, 24, *t.*
885	Studebaker	Studebaker Corp. of America, Detroit, Mich	4, 25, *t.*
900	Detroiter	Briggs-Detroiter Co., Detroit, Mich	4, 25, *r. t.*
900	Dispatch	Dispatch M. C. Co., Minneapolis, Minn	4, 30, *t.*
900	Empire	Empire Auto. Co., Indianapolis, Ind	4, 23, *t.*
900	Krit	Krit M. C. Co., Detroit, Mich	4, 28, *r.*
900	Perfex	The Perfex Co., Los Angeles, Cal	4, 16, *t.*
900	R. C. H	R. C. H. Corp., Detroit, Mich	4, 17, *r. t.*
950	Buick	Buick Motor Co., Flint, Mich	4, 24, *r.*
950	Krit	Krit M. C. Co., Detroit, Mich	4, 28, *t.*
950	Overland	Willys-Overland Co., Toledo, O	4, 27, *r. t.*
950	Lambert	Buckeye Manufacturing Co., Anderson, Ind	4, 25, *r.*
975	Comet	Continental Motors Corp., Buffalo, N. Y	4, 25, *t.*
975	Marathon	Herff-Brooks Corp., Indianapolis, Ind	4, 20, *t.*
975	Partin-Palmer	Partin Mfg. Co., Chicago, Ill	4, 38, *t.*
985	Continental	Martindale & Millikan	4, 20, *t.*
1,000	Dispatch	Dispatch M. C. Co., Minneapolis, Minn	4, 30, *c.*
1,025	Paige	Paige-Detroit M. C. Co., Detroit, Mich	4, 25, *t.*
1,050	Buick	Buick Motor Co., Flint, Mich	4, 25, *t.*
1,050	Monarch	Monarch M. C. Co., Detroit, Mich	4, 25, *t.*
1,050	Hupmobile	Hupp M. C. Co., Detroit, Mich	4, 32, *r. t.*
1,075	Lambert	Buckeye Mfg. Co., Anderson, Ind	4, 25, *r.*
1,125	Regal	Regal M. C. Co., Detroit, Mich	4, 25, *r. t.*
1,150	Crow-Elkhart	Crow M. C. Co., Elkhart, Ind	4, 35, *t.*
1,150	Oakland	Oakland M. C. Co., Pontiac, Mich	4, 36, *r.*
1,175	Reo	Reo M. C. Co., Lansing, Mich	4, 30, *r. t.*
1,195	King	King M. C. Co., Detroit, Mich	4, 30, *r. t.*
1,200	Hupmobile	Hupp M. C. Co., Detroit, Mich	4, 32, *t.*
1,200	Oakland	Oakland M. C. Co., Pontiac, Mich	4, 36, *t.*
1,200	Cameron	Cameron Mfg. Co., New Haven, Conn	4, 30, *r. t. c. s.*
1,200	Lambert	Buckeye Mfg. Co., Anderson, Ind	4, 30, *t.*
1,235	Paterson	W. A. Paterson Co., Flint, Mich	4, 33, *t.*
1,250	Case	J. I. Case T. M. Co., Racine, Wis	4, 25, *t.*
1,250	Cartercar	Cartercar Co., Pontiac, Mich	4, 30, *r. t.*
1,250	Herreshoff	Herreshoff Motor Co., Detroit, Mich	4, 30, *r.*
1,250	Light	Light M. C. Co., Detroit, Mich	6, 30, *t.*
1,250	Richmond	Wayne Works, Richmond, Ind	4, 27, *r. t.*
1,275	Ohio	Crescent Motor Co., Cincinnati, O	4, 35, *t.*
1,275	Paige	Paige-Detroit M. C. Co., Detroit, Mich	4, 36, *r. t.*
1,280	Lexington	Lexington M. C. Co., Connersville, Ind	4, 40, *t.*
1,290	Traveler	Traveler M. C. Co., Detroit, Mich	4, 28, *t.*
1,290	Studebaker	Studebaker Corp. of America, Detroit, Mich	4, 35, *t.*
1,300	R. C. H	R. C. H. Corp., Detroit, Mich	4, 17, *c.*
1,325	Marathon	Herff-Brooks Corp., Indianapolis, Ind	4, 30, *t.*
1,335	Davis	George W. Davis M. C. Co., Richmond, Ind	4, 35, *r. t.*
1,350	Metropol	Metropol Motors Co., New York City	4, 30, *r.*
1,350	Regal	Regal M. C. Co., Detroit, Mich	4, 35, *t.*
1,350	Herreshoff	Herreshoff Motor Co., Detroit, Mich	4, 30, *t.*
1,350	Hupmobile	Hupp M. C. Co., Detroit, Mich	4, 32, *c.*
1,365	Lambert	Buckeye Mfg. Co., Anderson, Ind	4, 35, *r.*
1,385	Jackson	Jackson Auto. Co., Jackson, Mich	4, 40, *t.*
1,395	Allen	Allen M. C. Co., Fostoria, O	4, 28, *r. t.*
1,395	Lambert	Buckeye Mfg. Co., Anderson, Ind	4, 40, *t.*
1,475	Chevrolet	Chevrolet Motor Co., Flint, Mich	6, 35, *t.*
1,490	Auburn	Auburn Auto. Co., Auburn, Ind	4, 40, *t.*
1,495	Marathon	Herff-Brooks Corp., Indianapolis, Ind	4, 32, *t.*
1,500	Imperial	Imperial Auto. Co., Jackson, Mich	4, 28, *r. t.*
1,500	Halladay	A. C. Barley, Streator, Ill	4, 38, *t.*
1,500	Velie	Velie M. Vehicle. Co., Moline, Ill	4, 35, *t.*
1,500	Alter-Car	Cincinnati M. Mfg. Co., Cincinnati, O	4, 33, *t.*
1,500	Day Utility	Day Auto. Co., Detroit, Mich	4, 33, *t.*
1,500	Jeffery	Thos. B. Jeffery Co., Kenosha, Wis	4, 23, *r. t.*
1,500	Overland	Willys-Overland Co., Toledo, O	4, 27, *c.*
1,500	Richmond	Wayne Works, Richmond, Ind	6, 38, *t.*
1,550	American	American Motors Co., Indianapolis, Ind	4, 26, *r.*
1,550	Studebaker	Studebaker Corp. of America, Detroit, Mich	6, 30, *t.*
1,585	Henderson	Henderson M. C. Co., Indianapolis, Ind	4, 44, *t.*
1,595	Mitchell	Mitchell-Lewis M. Co., Racine, Wis	4, 40, *r. t.*
1,600	Apperson	Apperson Bros. Auto. Co., Kokomo, Ind	4, 45, *r. t.*
1,600	Fal-Car	Fal Auto. Co., Chicago, Ill	4, 40, *r. t.*
1,600	Regal	Regal M. C. Co., Detroit, Mich	4, 25, *c.*
1,635	McIntyre	W. H. McIntyre Co., Auburn, Ind	6, 40, *t.*
1,650	Marion	Marion M. C. Co., Indianapolis, Ind	4, 26, *r. t.*
1,685	Kline Kar	Kline M. C. Corp., Richmond, Va	4, 30, *r. t.*
1,700	Cartercar	Cartercar Co., Pontiac, Mich	4, 36, *t.*
1,710	Great Western	Great Western Auto. Co., Peru, Ind	4, 40, *r. t.*
1,745	Ames	Ames M. C. Co., Owensboro, Ky	4, 28, *r.*
1,750	Crow-Elkhart	Crow M. C. Co., Elkhart, Ind	4, 40, *t.*
1,750	Paterson	W. A. Paterson Co., Flint, Mich	4, 41, *t.*
1,750	Moon	Moon M. C. Co., St. Louis, Mo	4, 42, *r. t.*
1,750	Crawford	Crawford Auto. Co., Haggerstown, Md	4, 37, *t.*
1,775	Chalmers	Chalmers Motor Co., Detroit, Mich	4, 36, *t.*
1,775	Pullman	Pullman M. C. Co., York, Pa	4, 36, *t.*
1,785	Apperson	Apperson Bros. Auto. Co., Kokomo, Ind	4, 45, *t.*
1,785	Abbott-Detroit	Abbott Motor Co., Detroit, Mich	4, 34, *r. t.*
1,785	Chandler	Chandler M. C. Co., Cleveland, O	6, 35, *t.*
1,785	Henderson	Henderson M. C. Co., Indianapolis, Ind	4, 46, *r. t.*
1,785	Oakland	Oakland M. C. Co., Pontiac, Mich	4, 43, *t.*
1,785	Oakland	Oakland M. C. Co., Pontiac, Mich	6, 48, *t.*
1,785	Ames	Ames M. C. Co., Owensboro, Ky	4, 28, *t.*
1,800	Buick	Buick Motor Co., Flint, Mich	4, 38, *c.*
1,800	Corbitt	Corbitt Auto. Co., Henderson, N. C	4, 33, *r.*
1,800	South Bend	South Bend M. C. Wks., South Bend, Ind	4, 50, *r.*
1,825	ArBenz	ArBenz Car Co., Chillicothe, O	4, 45, *r.*
1,850	Firestone-Columbus	Columbus Buggy Co., Columbus, O	4, 30, *r. t.*
1,850	Paige	Paige-Detroit M. C. Co., Detroit, Mich	4, 36, *c.*
1,850	Case	J. I. Case, T. M. Co., Racine, Wis	4, 35, *t.*
1,850	Herreshoff	Herreshoff Motor Co., Detroit, Mich	6, 45, *r. t.*
1,850	Schacht	Schacht M. C. Co., Cincinnati, O	4, 29, *t.*
1,875	Spaulding	Spaulding Mfg. Co., Grinnell, Ia	4, 40, *t.*
1,875	Rambler	Thos. B. Jeffery Co., Kenosha, Wis	4, 32, *t.*
1,885	Staver	Staver Carriage Co., Chicago, Ill	4, 55, *t.*
1,885	ArBenz	ArBenz Car Co., Chillicothe, O	4, 45, *t.*
1,885	Jackson	Jackson Auto. Co., Jackson, Mich	4, 45, *t.*
1,895	Mitchell	Mitchell-Lewis M. Co., Racine, Wis	6, 50, *r. t.*
1,900	Cartercar	Cartercar Co., Pontiac, Mich	4, 36, *c.*
1,925	Cole	Cole M. C. Co., Indianapolis, Ind	4, 29, *r. t.*
1,950	Moline	Moline Auto. Co., East Moline, Ill	4, 40, *t.*
1,950	Pacific Special	Cole California Car Co., Oakland, Cal	4, 33, *r. t.*
1,975	Cadillac	Cadillac M. C. Co., Detroit, Mich	4, 50, *r. t. p.*
$1,975	Pullman	Pullman M. C. Co., York, Pa	4, 44, *t.*
1,975	Corbitt	Corbitt Auto. Co., Henderson, N. C	4, 33, *t.*
1,975	Maxwell	Maxwell Motor Co., Detroit, Mich	6, 50, *t.*
1,985	Buick	Buick Motor Co., Flint, Mich	4, 55, *t.*
1,985	Havers	Havers M. C. Co., Port Huron, Mich	6, 44, *r. t.*
1,985	Kline Kar	Kline M. C. Corp., Richmond, Va	4, 40, *r. t.*
1,985	Ohio	Crescent Motor Co., Cincinnati, O	6, 60, *t.*
1,985	Haynes	Haynes Auto. Co., Kokomo, Ind	4, 29, *r. t.*
1,985	Davis	George W. Davis M. C. Co., Richmond, Ind	4, 50, *t.*
2,000	Velie	Velie M. Vehicle Co., Moline, Ill	4, 45, *r. t.*
2,000	Coey "Flyer"	Coey-Mitchell Auto. Co., Chicago, Ill	6, 50, *r. t.*
2,000	Stutz	Stutz M. C. Co., Indianapolis, Ind	4, 65, *r.*
2,000	Traveler	Traveler M. C. Co., Detroit, Mich	6, 48, *t.*
2,000	Imperial	Imperial Auto. Co., Jackson, Mich	6, 34, *t.*
2,000	Lenox	Lenox M. C. Co., Hyde Park, Mass	4, 40, *r. t.*
2,000	Auburn	Auburn Auto. Co., Auburn, Ind	6, 45, *t.*
2,050	Studebaker	Studebaker Corp. of America, Detroit, Mich	4, 35, *c.*
2,085	Abbott-Detroit	Abbott Motor Co., Detroit, Mich	4, 44, *t.*
2,100	Crawford	Crawford Auto. Co., Haggerstown, Md	4, 48, *t.*
2,100	Lozier	Lozier Motor Co., Detroit, Mich	4, —, *t.*
2,125	Firestone-Columbus	Columbus Buggy Co., Columbus, O	4, 40, *t.*
2,150	Marion	Marion M. C. Co., Indianapolis, Ind	4, 26, *c.*
2,150	Marion	Marion M. C. Co., Indianapolis, Ind	6, 34, *r. t.*
2,150	Pratt	Elkhart C. & H. Mfg. Co., Elkhart, Ind	4, 50, *t.*
2,150	Moon	Moon M. C. Co., St. Louis, Mo	6, 58, *r. t.*
2,150	Jackson	Jackson Auto. Co., Jackson, Mich	6, 55, *t.*
2,150	Davis	George W. Davis M. C. Co., Richmond, Ind	6, 50, *t.*
2,160	Pathfinder	Motor Car Mfg. Co., Indianapolis, Ind	4, 40, *r.*
2,175	Chalmers	Chalmers Motor Co., Detroit, Mich	6, 40, *r. t.*
2,185	De Soto	De Soto M. C. Co., Auburn, Ind	6, 38, *t.*
2,185	Zimmerman	Zimmerman Mfg. Co., Auburn, Ind	6, 38, *t.*
2,185	Pathfinder	Motor Car Mfg. Co., Indianapolis, Ind	4, 40, *t.*
2,200	Apperson	Apperson Bros. Auto. Co., Kokomo, Ind	6, 45, *r. t.*
2,225	Moon	Moon M. C. Co., St. Louis, Mo	6, 58, *t.*
2,250	Pilot	Pilot Motor Sales Co., Richmond, Ind	4, 50, *r. t.*
2,250	Pope	Pope Mfg. Co., Hartford, Conn	4, 31, *r. t.*
2,250	Hudson	Hudson M. C. Co., Detroit, Mich	6, 55, *p.*
2,250	Crow-Elkhart	Crow M. C. Co., Elkhart, Ind	6, 50, *t.*
2,250	Great Southern	Great So. Auto. Co., Birmingham, Ala	4, 60, *t.*
2,250	Pope-Hartford	Pope Manufacturing Company, Hartford, Conn	4, 40, *r. t.*
2,250	South Bend	South Bend M. C. Wks., South Bend, Ind	6, 55, *t.*
2,285	Henderson	Henderson M. C. Co., Indianapolis, Ind	6, 54, *r. t.*
2,290	Abbott-Detroit	Abbott Motor Co., Detroit, Mich	6, 50, *r. t.*
2,295	Palmer-Singer	Palmer & Singer Mfg. Co., Long Island City	6, 50, *r. t.*
2,300	Franklin	H. H. Franklin Mfg. Co., Syracuse, N. Y	6, 30, *r. t.*
2,300	Case	J. I. Case T. M. Co., Racine, Wis	4, 40, *t.*
2,300	Jeffery	Thos. B. Jeffery Co., Kenosha, Wis	6, 34, *t.*
2,350	Apperson	Apperson Bros. Auto. Co., Kokomo, Ind	6, 55, *r. t.*
2,350	Kissel Kar	Kissel M. C. Co., Hartford, Wis	6, 48, *r. t.*
2,350	Stafford	Stafford M. C. Co., Kansas City, Mo	4, 42, *r. t.*
2,350	Mitchell	Mitchell-Lewis M. Co., Racine, Wis	6, 60, *t.*
2,350	Velie	Velie M. Vehicle Co., Moline, Ill	6, 50, *r. t.*
2,375	Howard	Howard M. C. Co., Connersville, Ind	6, 60, *t.*
2,385	Halladay	A. C. Barley, Streator, Ill	6, 50, *t.*
2,400	Pullman	Pullman M. C. Co., York, Pa	6, 48, *t.*
2,400	Stutz	Stutz M. C. Co., Indianapolis, Ind	6, 65, *t.*
2,485	Havers	Havers M. C. Co., Port Huron, Mich	6, 60, *r. t.*
2,485	S. & M.	S. & M. Motor Co., Detroit, Mich	6, 48, *r. t.*
2,500	Colby	Colby Motor Co., Mason City, Ia	6, 60, *t*
2,500	Moyer	H. A. Moyer, Syracuse, N. Y	4, 50, *t.*
2,500	Luverne	Luverne Auto. Co., Luverne, Minn	6, 60, *t.*
2,500	Grout	Grout Auto. Co., Orange, Mass	6, 44, *t.*
2,500	Dorris	Dorris M. C. Co., St. Louis, Mo	4, 30, *t.*
2,500	A. E. C	Angar Engineering Co., Milwaukee, Wis	6, 50, *t.*
2,500	Pathfinder	Motor Car Mfg. Co., Indianapolis, Ind	4, 40, *c.*
2,500	White	The White Co., Cleveland, O	4, 30, *r. t.*
2,500	Imperial	Imperial Auto. Co., Jackson, Mich	6, 45, *t.*
2,500	Croxton	Croxton M. C. Co., Washington, Pa	4, 35, *t, ld.*
2,500	Apperson	Apperson Bros. Auto. Co., Kokomo, Ind	4, 45, *l.*
2,500	Cadillac	Cadillac M. C. Co., Detroit, Mich	4, 50, *c. ld.*
2,500	Chevrolet	Chevrolet Motor Co., Flint, Mich	6, 40, *t.*
2,500	Studebaker	Studebaker Corp. of America, Detroit, Mich	6, 30, *l.*
2,550	Pratt	Elkhart C. & H. Mfg. Co., Elkhart, Ind	6, 60, *t.*
2,585	Kline Kar	Kline M. C. Corp., Richmond, Va	6, 50, *r. t.*
2,590	McFarlan	McFarlan M. Co., Connersville, Ind	6, 50, *r. t.*
2,600	Cole	Cole M. C. Co., Indianapolis, Ind	6, 44, *r. t.*
2,600	Mercer	Mercer Automobile Co., Trenton, N. J	4, 31, *r.*
2,600	Oakland	Oakland M. C. Co., Pontiac, Mich	4, 43, *s.*
2,650	Firestone-Columbus	Columbus Buggy Co., Columbus, O	6, 55, *t.*
2,650	Burg	L. Burg Carriage Co., Dallas City, Ill	6, 60, *t.*
2,650	Rayfield	Rayfield Motor Co., Chrisman, Ill	6, 38, *r. t.*
2,685	Norwalk	Norwalk M. C. Co., Martinsburg, W. Va	6, 62, *t.*
2,700	Haynes	Haynes Auto. Co., Kokomo, Ind	4, 29, *c.*
2,735	Premier	Premier Motor Mfg. Co., Indianapolis, Ind	6, 38, *r. t.*
2,750	Moon	Moon M. C. Co., St. Louis, Mo	6, 58, *c.*
2,750	Staver	Staver Carriage Co., Chicago, Ill	6, 65, *t.*
2,750	Lenox	Lenox M. C. Co., Hyde Park, Mass	6, 60, *t.*
2,750	Pathfinder	Motor Car Mfg. Co., Indianapolis, Ind	6, 60, *t.*
2,750	Garford	The Garford Co., Elyria, O	6, 44, *t.*
2,750	Inter-State	Inter-State Auto. Co., Muncie, Ind	6, 40, *t.*
2,785	Pilot	Pilot Motor Sales Co., Richmond, Ind	6, 60, *r. t.*
2,800	Cadillac	Cadillac M. C. Co., Detroit, Mich	4, 50, *l.*
2,850	Pullman	Pullman M. C. Co., York, Pa	6, 66, *t.*
2,850	Speedwell	Speedwell M. C. Co., Dayton, O	6, 55, *t.*
2,850	W. F. S.	W. F. S. Motor Car Co., Philadelphia, Pa	4, 40, *r. t.*
2,860	Premier	Premier Motor Mfg. Co., Indianapolis, Ind	6, 38, *t.*
2,900	Lyons-Knight	Lyons Atlas Co., Indianapolis, Ind	4, 50, *t.*
2,900	Mercer	Mercer Automobile Co., Trenton, N. J	4, 32, *t.*
2,950	Speedwell	Speedwell M. C. Co., Dayton, O	6, 55, *t.*
2,950	Franklin	H. H. Franklin Mfg. Co., Syracuse, N. Y	6, 30, *c.*
2,975	Oldsmobile	Olds Motor Works, Lansing, Mich	6, 50, *t.*
2,985	Kline Kar	Kline M. C. Corp., Richmond, Va	6, 60, *r. t.*
3,000	A. E. C.	Anger Engineering Co., Milwaukee, Wis	6, 60, *t.*
3,000	Marmon	Nordyke & Marmon Co., Indianapolis, Ind	4, 32, *r. t.*
3,000	Cole	Cole M. C. Co., Indianapolis, Ind	6, 44, *c.*
3,000	W. F. S.	W. F. S. Motor Car Co., Philadelphia, Pa	6, 60, *r. t.*
3,100	Hudson	Hudson M. C. Co., Detroit, Mich	6, 55, *s.*
3,100	Lyons-Knight	Lyons Atlas Co., Indianapolis, Ind	6, 50, *t.*
3,150	Kissel Kar	Kissel M. C. Co., Hartford, Wis	6, 60, *r. t.*
3,150	National	National Motor Vehicle Co., Indianapolis, Ind	4, 38, *r.*
3,200	Firestone-Columbus	Columbus Buggy Co., Columbus, O	4, 40, *l.*
3,250	Winton	Winton M. C. Co., Cleveland, O	6, 48, *t.*
3,250	Keeton	Keeton Motor Co., Detroit, Mich	6, 48, *r. t.*
3,250	Lozier	Lozier Motor Co., Detroit, Mich	6, 62, *t.*
3,250	Moyer	H. A. Moyer, Syracuse, N. Y	6, 70, *t.*
3,250	Touraine	The Touraine Co., Philadelphia, Pa	6, 63, *t.*
3,250	Pope	Pope Mfg. Co., Hartford, Conn	4, 31, *l.*
3,250	Pope	Pope Mfg. Co., Hartford, Conn	4, 36, *t.*
3,300	Knox	Knox Automobile Co., Springfield, Mass	4, 40, *r.*
3,300	Franklin	H. H. Franklin Mfg. Co., Syracuse, N. Y	6, 30, *l.*
3,300	McFarlan	McFarlan M. Co., Connersville, Ind	6, 50, *c.*
3,300	National	National Motor Vehicle Co., Indianapolis, Ind	4, 38, *t.*
3,300	White	The White Co., Cleveland, O	4, 40, *r. t.*
3,350	Kissel Kar	Kissel M. C. Co., Hartford, Wis	6, 48, *c.*
3,400	National	National Motor Vehicle Co., Indianapolis, Ind	4, 38, *t.*

* Indicates price for chassis only; bodies to order.

(*Concluded on page 28.*)

A Price List and Table of 1914 American Gasoline Pleasure Cars

(Concluded from page 26.)

Price.	Name of Car.	Name and Address of Manufacturer.	No. of Cylinders, Horse-power and Body Type.
$3,500	S. G. V.	S. G. V. Co., Reading, Pa.	4, 36, *r. t.*
3,500	Cunningham	J. Cunningham Sons & Co., Rochester, N. Y.	4, 40, *t.*
3,500	Frontenac	Abendroth & Root Mfg. Co., Newburgh, N. Y.	4, —, *t.*
3,500	Marmon	Nordyke & Marmon Co., Indianapolis, Ind.	6, 41, *r. t.*
3,500	Norwalk	Norwalk M. C. Co., Martinsburg, W. Va.	6, 74, *t.*
3,500	California-Six	Cole California Car Co., Oakland, Cal.	6, 44, *r. t.*
3,500	Knox	Knox Automobile Co., Springfield, Mass.	4, 40, *t.*
3,500	S. & M.	S. & M. Motor Co., Detroit, Mich.	6, 48, *l.*
3,500	Rayfield	Rayfield Motor Co., Chrisman, Ill.	6, 38, *c.*
3,525	Palmer-Singer	Palmer & Singer Mfg. Co., Long Island City	6, 70, *t.*
3,600	Chalmers	Chalmers Motor Co., Detroit, Mich.	6, 40, *l.*
3,600	Dorris	Dorris M. C. Co., St. Louis, Mo.	4, 30, *l.*
3,750	Stearns-Knight	F. B. Stearns Co., Cleveland, O.	4, 30, *r. t.*
3,850	Packard	Packard M. C. Co., Detroit, Mich.	6, 38, *r. t.*
3,975	Keeton	Keeton Motor Co., Detroit, Mich.	6, 48, *l.*
4,000	Premier	Premier Motor Mfg. Co., Indianapolis, Ind.	6, 48, *r. t.*
4,000	Cole	Cole M. C. Co., Indianapolis, Ind.	6, 44, *l.*
4,000	Austin	Austin Automobile Co., Grand Rapids, Mich.	6, 55, *r. t.*
4,000	Fiat	Fiat Automobile Co., Poughkeepsie, N. Y.	4, 35, *r. t. p.*
4,100	Kissel Kar	Kissel M. C. Co., Hartford, Wis.	6, 48, *l.*
4,250	S. G. V.	S. G. V. Co., Reading, Pa.	4, 36, *c. l. ld.*
4,300	Pierce-Arrow	Pierce-Arrow M. C. Co., Buffalo, N. Y.	6, 38, *t.*
4,300	Oldsmobile	Olds Motor Works, Lansing, Mich.	6, 50, *l.*
4,300	Peerless	Peerless M. C. Co., Cleveland, O.	6, 38, *t.*
4,300	Lyons-Knight	Lyons Atlas Co., Indianapolis, Ind.	4, 50, *b.*
4,350	Winton	Winton M. C. Co., Cleveland, O.	6, 48, *c. l.*
4,400	Locomobile	Locomobile Co. of America, Bridgeport, Conn.	6, 63, *r. t.*
4,450	Stearns-Knight	F. B. Stearns Co., Cleveland, O.	4, 30, *c.*
4,500	Fiat	Fiat Automobile Co., Poughkeepsie, N. Y.	4, 55, *r. t. p.*
4,500	Knox	Knox Automobile Co., Springfield, Mass.	6, 46, *r. t.*
4,550	Stevens-Duryea	Stevens-Duryea Co., Chicopee Falls, Mass.	6, 45, *r. t.*
$4,600	Winton	Winton M. C. Co., Cleveland, O.	6, 48, *l. ld.*
4,600	Cunningham	J. Cunningham Sons & Co., Rochester, N. Y.	4, 40, *l. ld.*
4,650	Kissel Kar	Kissel M. C. Co., Hartford, Wis.	6, 60, *l.*
4,850	Stearns-Knight	F. B. Stearns Co., Cleveland, O.	6, 43, *r. t.*
5,000	Pierce-Arrow	Pierce-Arrow M. C. Co., Buffalo, N. Y.	6, 48, *t.*
5,000	Stevens-Duryea	Stevens-Duryea Co., Chicopee Falls, Mass.	6, 45, *c.*
5,000	Packard	Packard M. C. Co., Detroit, Mich.	6, 38, *l.*
5,000	Marmon	Nordyke & Marmon Co., Indianapolis, Ind.	6, 48, *r. t.*
5,000	Peerless	Peerless M. C. Co., Cleveland, O.	6, 48, *t.*
5,000	White	The White Co., Cleveland, O.	6, 60, *t.*
5,000	Austin	Austin Automobile Co., Grand Rapids, Mich.	6, 55, *l.*
5,000	Austin	Austin Automobile Co., Grand Rapids, Mich.	6, 66, *r. t.*
5,000	Fiat	Fiat Automobile Co., Poughkeepsie, N. Y.	6, 50, *r. t. p.*
5,000	Stearns-Knight	F. B. Stearns Co., Cleveland, O.	4, 30, *l. s.*
5,100	Locomobile	Locomobile Co. of America, Bridgeport, Conn.	6, 75, *r. t.*
5,500	Knox	Knox Automobile Co., Springfield, Mass.	6, 46, *l.*
5,500	Chadwick	Chadwick Eng. Wks., Pottstown, Pa.	6, 60, *r. t.*
5,500	Simplex	Simplex Auto. Co., New Brunswick, N. J.	4, 38, *t.*
5,700	Locomobile	Locomobile Co. of America, Bridgeport, Conn.	6, 63, *b.*
6,000	Stevens-Duryea	Stevens-Duryea Co., Chicopee Falls, Mass.	6, 45, *l.*
6,000	Simplex	Simplex Auto. Co., New Brunswick, N. J.	4, 50, *t.*
6,000	Austin	Austin Automobile Co., Grand Rapids, Mich.	6, 77, *r. t.*
6,000	Fiat	Fiat Automobile Co., Poughkeepsie, N. Y.	6, 50, *l.*
6,100	Stearns-Knight	F. B. Stearns Co., Cleveland, O.	6, 43, *l. s.*
6,300	White	The White Co., Cleveland, O.	6, 60, *l.*
6,500	Chadwick	Chadwick Eng. Wks., Pottstown, Pa.	6, 60, *l.*
6,500	Simplex	Simplex Auto. Co., New Brunswick, N. J.	4, 38, *l. ld.*
7,000	Peerless	Peerless M. C. Co., Cleveland, O.	6, 60, *l.*
7,000	Austin	Austin Automobile Co., Grand Rapids, Mich.	6, 77, *l.*
7,100	Pierce-Arrow	Pierce-Arrow M. C. Co., Buffalo, N. Y.	6, 66, *l.*
8,000	Crane	Crane M. C. Co., Bayonne, N. J.	6, 46, *

Abbreviations used in the list: *r* Roadster; *t*, Touring Car; *l*, Limousine; *c*, Coupe; *ld*, Landaulet; *p*, Phaeton; *b*, Berline; *s*, Sedan. *Indicates price for chassis only; bodies to order.

American Electric Pleasure Cars of 1914: Their Makers and Prices

A Table Designed to Answer the Question: "What Electric Pleasure Car is Within My Price?"

Price.	Name of Vehicle.	Name and Address of Manufacturer.	Passenger Capacity and Type of Body.
$1,650	Hupp-Yeats	R-C-H Corporation, Detroit, Mich.	2, Torpedo.
1,750	Hupp-Yeats	R-C-H Corporation, Detroit, Mich.	4, Regent.
1,990	Standard	Standard Electric Car Co., Jackson, Mich.	4, Coupé
2,000	Fritchle	Fritchle Auto. and Battery Co., Denver, Col.	2, Victoria.
2,150	Columbus	Columbus Buggy Co., Columbus, O.	2, Roadster
2,150	Hupp-Yeats	R-C-H Corporation, Detroit, Mich.	4, Patrician.
2,200	Dayton	Dayton Electric Car Co., Dayton, O.	2, Victoria.
2,250	Columbus	Columbus Buggy Co., Columbus, O.	4, Stanhope.
2,300	Anderson	Anderson Electric Car Co., Detroit, Mich.	4, Victoria.
2,300	Baker	Baker Motor Vehicle Co., Cleveland, O.	2, Roadster
2,350	Columbus	Columbus Buggy Co., Columbus, O.	4, Coupé
2,500	Tiffany	Tiffany Electric Car Co., Pontiac, Mich.	5, Coupé.
2,500	Argo	Argo Electric Vehicle Co., Saginaw, Mich.	4, Roadster.
2,500	Bailey	S. R. Bailey & Co., Boston, Mass.	2, Roadster.
2,500	Fritchle	Fritchle Auto. and Battery Co., Denver, Col.	5, Touring.
2,500	Woods	Woods Motor Vehicle Co., Chicago, Ill.	3, Roadster.
2,550	Anderson	Anderson Electric Car Co., Detroit, Mich.	4, Brougham.
2,550	Borland	Borland-Grannis Co., Chicago, Ill.	3, Roadster.
2,550	Detroit	Detroit Electric Vehicle Co., Detroit, Mich.	4, Brougham.
2,600	Buffalo	Buffalo Electric Vehicle Co., Buffalo, N. Y.	2, Roadster.
2,600	Rauch & Lang	Rauch & Lang Carriage Co., Cleveland, O.	3, Roadster.
2,650	Century	Century Electric Car Co., Detroit, Mich.	4, Coupé.
2,700	Dayton	Dayton Electric Car Co., Dayton, O.	4, Coupé.
2,800	Argo	Argo Electric Vehicle Co., Saginaw, Mich.	4, Brougham.
2,800	Baker	Baker Motor Vehicle Co., Cleveland, O.	4, Coupé.
2,800	Rauch & Lang	Rauch & Lang Carriage Co., Cleveland, O.	4, Brougham.
2,830	Waverley	The Waverley Co., Indianapolis, Ind.	4, Coupé.
2,850	Detroit	Detroit Electric Vehicle Co., Detroit, Mich.	4, Rdstr. & Bg.
2,900	Broc	Broc Electric Vehicle Co., Cleveland, O.	4, Brougham.
2,900	Ohio	Ohio Electric Car Co., Toledo, O.	5, Brougham.
$2,900	Bailey	S. R. Bailey & Co., Boston, Mass.	2, Roadster.
2,900	Buffalo	Buffalo Electric Vehicle Co., Buffalo, N. Y.	4, Coupé.
2,900	Borland	Borland-Granis Co., Chicago, Ill.	5, Coupé.
2,900	Ohio	Ohio Electric Car Co., Toledo, O.	4, Coupé.
2,950	Grinnell	Grinnell Electric Car Co., Detroit, Mich.	4, Coupé.
3,000	Anderson	Anderson Electric Car Co., Detroit, Mich.	5, Brougham.
3,000	Buffalo	Buffalo Electric Vehicle Co., Buffalo, N. Y.	5, Brougham.
3,000	Chicago	Chicago Electric Motor Car Co., Chicago, Ill.	4, Limousine.
3,000	Columbus	Columbus Buggy Co., Columbus, O.	5, Coupé.
3,000	Woods	Woods Motor Vehicle Co., Chicago, Ill.	4, Brougham.
3,100	Argo	Argo Electric Vehicle Co., Saginaw, Mich.	5, Limousine.
3,100	Baker	Baker Motor Vehicle Co., Cleveland, O.	5, Brougham.
3,100	Broc	Broc Electric Vehicle Co., Cleveland, O.	5, Brougham.
3,100	Rauch & Lang	Rauch & Lang Carriage Co., Cleveland, O.	5, Coach.
3,150	Waverley	The Waverley Co., Indianapolis, Ind.	4, Brougham.
3,200	Ohio	Ohio Electric Car Co., Toledo, O.	5, Brougham.
3,200	Grinnell	Grinnell Electric Car Co., Detroit, Mich.	5, Coupé.
3,200	Woods	Woods Motor Vehicle Co., Chicago, Ill.	5, Brougham.
3,200	Ohio	Ohio Electric Car Co., Toledo, O.	5, Coupé-Br'gm
3,250	Century	Century Electric Car Co., Detroit, Mich.	5, Brougham.
3,300	Bailey	S. R. Bailey & Co., Boston, Mass.	4, Roadster.
3,300	Chicago	Chicago Electric Motor Car Co., Chicago, Ill.	5, Limousine.
3,400	Grinnell	Grinnell Electric Car Co., Detroit, Mich.	5, Brougham.
3,500	Ohio	Ohio Electric Car Co., Toledo, O.	5, Colonial.
3,500	Waverley	The Waverley Co., Indianapolis, Ind.	5, Limousine.
3,500	Ohio	Ohio Electric Car Co., Toledo, O.	5, Coupé.
3,600	Broc	Broc Electric Vehicle Co., Cleveland, O.	5, Brougham.
3,600	Fritchle	Fritchle Auto. and Battery Co., Denver, Col.	5, Brougham.
3,800	Rauch & Lang	Rauch & Lang Carriage Co., Cleveland, O.	7, Limousine.
5,500	Borland	Borland-Grannis Co., Chicago, Ill.	7, Limousine.

Retrospect of the Year 1913

(Concluded from page 7.)

structions laid upon this specimen by conflicting authorities. At present all evidence seems to be in favor of the view that a race of man somewhat similar to modern civilized man has existed for a very long period of time, and was coeval with the very low Heidelberg and similar types. Reports of the experimental solar power plant in Egypt are very encouraging, and we shall look with interest for further developments in this direction. Molecular physics continues to be one of the most actively developing fields of research. We have come to look upon atomic weight as not necessarily defining one single element—several elements may have the same, or very nearly the same atomic weights, according to the point of view developed by Prof. Soddy. Dr. Hevesy, speaking at the British Association on "Radioactive Elements as Indicators in Physics and Chemistry," pointed out the extreme delicacy of radioactive methods of observation: "By means of an α ray electroscope it is possible to measure exactly as small a quantity as 10^{-17} grammes of radioactive substance having a half-period of one hour." By the aid of such methods 10^{-9} milligrammes of lead is quantitatively determinable. Sir Oliver Lodge's address attracted considerable popular attention, mainly on account of his reference to spiritualistic phenomena. It can hardly be said to have brought to light any strikingly new facts or viewpoints. Wireless telegraphy in the service of meteorology and allied sciences has won a triumph in the establishment of radio-telegraphic connection between the Eiffel Tower, Paris, and the radio tower at Arlington, Va., near Washington, D. C. In the field of eugenics the camp has recently suffered a somewhat sharp scission. The general of the American forces, Prof. Davenport, has advocated the doctrine "let the weak wed the strong," as opposed to the Pearsonian doctrine "let the strong wed the strong." Davenport contends that the doctrine of the English school is theoretically correct, but practically incapable of application, as it would restrict marriages to a point suicidal to the race. With all these discussions as to what eugenic practice ought to be, one is led to wonder what actual practice is. Has the preaching of the eugenist had any measurable effect? Perhaps this can be claimed for it, that it has influenced legislation in favor of restricting the offspring of defectives. The Pasteur Institute has just celebrated its twenty-fifth anniversary—and what institution can show a record of greater success and usefulness for the same period than this great life-saving station? Two records made during the year seem to deserve special mention. The highest altitude reached by a sounding balloon has been raised from 20.15 to 23.4 miles. Mount McKinley has been scaled by Archdeacon Hudson Stuck and his party.

Obituary.

In noting briefly—as needs we must—the death roll of the past year, we mention first the death of John Fritz, a pioneer ironmaster, and one of the most distinguished manufacturers in that iron and steel industry in which this country leads the world. Fritz was the typical successful American inventor. Born of German and Scotch parents in 1822, he picked up his practical education while working on a farm. In 1844, as an apprentice to a mill for rolling bar iron, he came into touch with the great industry in which he was to become a leading figure. When the Bessemer process was introduced into this country Fritz, with Holley and Jones, applied his genius to the improvement of the process. By taking up the manufacture of armor plate, he assisted in the re-creation of our navy. The universities owe much to his influence and assistance, and he was honored by the engineering societies, both of this country and Great Britain. He founded the John Fritz Gold Medal, and his personal qualities made him endeared to the whole engineering fraternity.

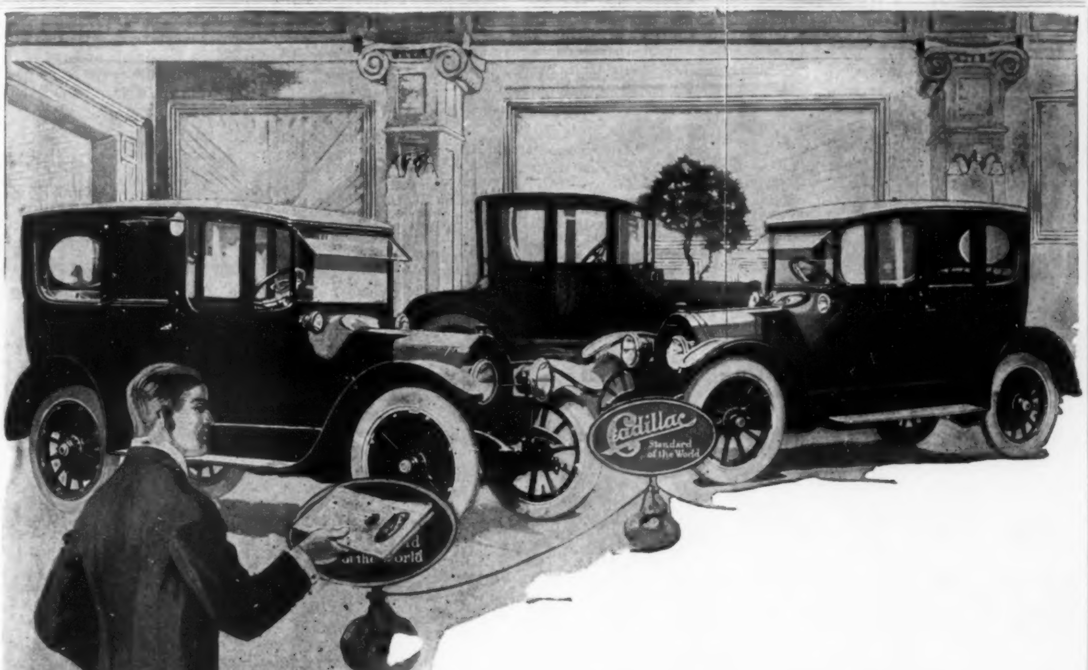
In Sir William White the world lost its most distinguished and widely known naval architect. For many years he was the Director of Naval Construction and Assistant Controller of the Royal Navy; and no architect has left so strong an imprint upon warship design. As consulting architect for the "Mauretania" and "Lusitania" he had much to do with the design of these famous vessels. Knighthood was but one of many distinguished honors conferred upon Sir William during his long and exceedingly active life.

In Gustav de Laval, the technical world lost one of its most brilliant inventors. It has been estimated that the cream separator and milk tester devised by him saved millions of dollars to the world's dairy interests alone. He was a pioneer in the construction of the steam turbine. Like Fritz and White, he combined with his inventive and constructive ability the advantages of great worth of character.

Another deplorable loss of the year was the untimely death of Rudolph Diesel, the inventor of the famous oil engine which bears his name. His fame may well rest upon the results already achieved with his invention. What the future has in store can be only surmised; but it is certain that the Diesel engine will take rank with the Parsons turbine as marking one of the epochs in that development of prime movers which opened with the work of James Watt.

The passing of Alfred Russel Wallace reminded those who knew, and informed the great multitude who did not know, that this distinguished scientist was the co-founder with Darwin of the modern theory of evolution. Strange indeed it was that two men at opposite ends of the earth should have worked out, unknown to each other, an identical solution of the problem of the genesis of species. But so it was. Wallace was far from being a narrow pedant, wedded to his specialty to the exclusion of other matters; for he was a man of broad interests and deep sympathy. He leaves his luminous writings as a monument to his industry and his long sustained devotion to the advancement of truth.

The death of Lieut. Col. C. D. Gaillard, after his return from the Panama Canal in broken health, was recognized as one more instance of the sacrifice of self to duty, of which there are so many brilliant examples among the naval and military men of this country. To Col. Gaillard, who, for six years, had charge of the excavation of the Culebra cut, was due the wonderful organization which enabled that stupendous work to be done with the speed and economy which marked its progress. Somewhere in the great cut, a grateful country should erect a fitting monument to the technical skill and personal devotion of this distinguished army engineer.



CADILLAC ENCLOSED CARS

We do not think it will be possible for you to suggest to yourself any sense in which the beauty and luxury of Cadillac Enclosed Cars could be heightened.

Cadillac
Standard of the World

The appointments are rich and dignified. They are executed with a quiet good taste which envelopes mind and body in complete content.

In the rich, soft upholstering, the superb, velvety riding qualities, the quiet, powerful, smooth running engine, the dependable Cadillac Delco electrical cranking device, the electric lights, together with the infinite care manifested in perfecting every minute detail, a degree of luxury is attained which leaves nothing more to be desired—nothing more to be obtained.

They are every day becoming more and more the choice of those discriminating buyers to whom price is not a consideration but who prefer the Cadillac because they find in it all of those attributes which make for constant and enduring service and complete satisfaction in the highest sense.

The line of enclosed cars comprise three types as follows: Seven passenger Standard Limousine at \$3250, Five passenger Inside Drive Limousine at \$2800, Three passenger Landaulet Coupe at \$2500, all completely equipped. Prices are f. o. b. Detroit.

Cadillac Motor Car Co. Detroit, Mich.

How British authorities regard the Cadillac two-speed axle

"The Autocar" says

"It would be difficult to outline an ideal car without this feature."

In conjunction with the recent award of the Dewar Trophy to the Cadillac—the second time within five years that this treasured mark of merit has been bestowed on the Cadillac—it is interesting to note how British automobile authorities regard the Cadillac's two-speed direct-drive axle.

This axle was even more of an innovation in Great Britain and Europe than in the United States; but it is very evident, from published comments, that it has found immense favor among those qualified to speak with authority on the subject of motor car advancement.

The Autocar, one of the leading motor publications of England, declaring it would be difficult to outline an ideal car that did not incorporate this feature, says:

"When the Cadillac system of combining ignition, lighting and engine starting in one electrical system was introduced two years ago, it was very properly regarded as a bold step; experience has shown it to be as successful as it was bold. Today the Cadillac designers have made another innovation, which, personally, we regard as even a greater improvement than the very important one of two years ago. As a basis, they have taken the old idea of two pairs of bevel gears, either pair working alternately and giving the car two different gear ratios; but the way in which the Cadillac designers have adopted it is new, and the working results are not merely satisfactory; they are so good that they mark a distinct forward step toward the long-sought ideal of direct and noiseless gears on all speeds.

"We have had a good bit of experience with high-geared fourth speeds, the direct drive on the third speed and the indirect on the fourth. We found these indirect fourths pleasant to use, but the moment we put in the high indirect fourth, the gear box began to make its working apparent. Now, with the Cadillac one gets all the advantages of the high fourth, but without the noise; it simply, as it were, calms down on the engine without any counter balancing noise or other objection.

"After once experiencing the delight of two direct and noiseless drives one feels that it is difficult to outline an ideal car which does not contain this feature, and we feel fairly safe in asserting that the Cadillac-successful reintroduction of an old idea will be followed by other makers."

"The Motor," another British technical authority, comments

"We have always held the Cadillac in the highest esteem, and admired it as a criterional example of high-grade American construction. The charm of the dual drive to the rear axle is compelling and entrancing, and as one merely touches the little lever at the side and, on depressing and allowing the clutch to rise, finds a higher direct drive available, wonderment is aroused as to the undoubtedly simple manner in which so great an advantage has been brought about.

"The luxury of driving a touring car at 20 or 25 miles an hour with a direct drive and final gear ratio of 2.5 to 1 is quite a new fascination."

From "Horseless Age."

"It seems at least possible that the two-speed axle may confer upon the four-cylinder car sufficient flexibility and accelerative ability, without recourse to noisy geared speeds, to satisfy the public demand for these qualities, and, if this should prove to be the case, the demand for six-cylinder cars, with their somewhat more costly, more bulky, more complicated and less economical motors, might be materially reduced. It can hardly be doubted that the advent of the double-direct drive is one of the most important happenings of recent years in the automobile industry."

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

LOW CUT SHOE ATTACHMENT.—W. E. BUNKER, Natick, Mass. This invention relates to "pumps" or low-cut shoes, and provides an attachment to prevent the shoe from spreading or gaping in the movements of walking. The invention provides a stiffener whose use will not result in discomfort at the back of the heel, and the stiffener may be readily attached to any low-cut shoe.

WARDROBE TRUNK.—M. CHERRY, JR., 226 5th Ave., Larchmont Manor, N. Y. The object of the invention is to provide a simple, strong and compact carriage, which will accommodate hangers, extending through the entire width of the trunk and will prevent any displacement of the hangers when engaged in the same carriage frame.

LOCKING DEVICE FOR CLASPS.—M. SCHIFF, care of Samuel D. Schwitzer, 309 Broadway, N. Y., N. Y. This device is for use as the clasp of a bracelet, necklace or other article of jewelry, and is arranged to prevent accidental opening of the clasp, to be inconspicuous and avoid marring of the appearance of the article, and to present no undesirable projection on the surface of the article.

Electrical Devices.

ELECTRIC FIRE ALARM.—F. RICORDS and M. LEWRY, care of the latter, 573 Washington Ave., Brooklyn, N. Y. This alarm relates to alarms which may be installed in a building with an indicator on each floor having a bell and a switch, with electrical connections for ringing all the bells and for lighting a certain lamp on each floor when an alarm is given, by closing one of the switches.

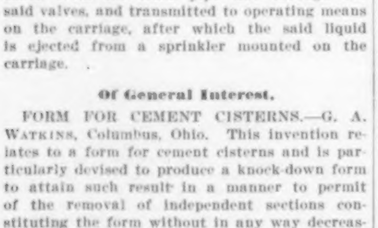
ELECTRIC-MOTOR DRIVING UNIT.—M. TAIGMAN, 239 Wooster St., New York, N. Y. The invention pertains to improvements in individual motor equipments for power-driven machines, and more particularly to equipments to be installed for operating bench machines and controlled by means of foot-operated devices.

Of Interest to Farmers.

COMBINATION CUSHIONED FLAT AND FILLER.—W. MERKER, 22 Covert St., Brooklyn, N. Y. The purpose in this case is to provide a cushioned flat and filler arranged to reduce breakage of eggs while in the egg carrier to a minimum and to protect the members forming the filler from being bent or broken, thus insuring long life of the egg carrier and permitting its re-use for a long period.

CORN PLANTER.—E. J. OGDEN, 502½ N. Sixth St., Springfield, Ill. The invention more particularly is directed to an improved means for actuating the seed dropping mechanism whereby the seed may be deposited at certain intervals in the ground. The principal object is to provide a planter having efficient means for actuating the seed dropping mechanism.

IRRIGATING APPARATUS.—G. S. WILLIAMSON, Elk Grove, Cal. The purpose here is to supply an apparatus adapted for use in sprinkling large fields and the like, the liquid employed in sprinkling being adapted to operate the sprinkling mechanism. For this, use



IRRIGATING APPARATUS.

is made of a track pipe line provided with valves, and a carriage mounted to operate over the track pipe line and moved by the liquid taken from the track pipe line through the said valves, and transmitted to operating means on the carriage, after which the said liquid is ejected from a sprinkler mounted on the carriage.

Of General Interest.

FORM FOR CEMENT CISTERNS.—G. A. WATKINS, Columbus, Ohio. This invention relates to a form for cement cisterns and is particularly devised to produce a knock-down form to attain such result in a manner to permit of the removal of independent sections constituting the form without in any way decreasing the security of the remaining parts in their proper position.

STREAM DEFLECTOR.—W. H. DEAN, P. O. Box 53, Morningside, Sioux City, Iowa. The inventor provides a deflector more especially designed for use in rivers and other waterways, and arranged to divert or deflect the current of the waterway with a view to prevent the same cutting into the bank, to maintain a channel along a proper predetermined line and to insure the formation of a permanent shore line.

MILK BOTTLE HOLDER.—J. J. DUNN, 4580 Park Ave., New York, N. Y. This invention provides a holder locked in holding position only when having contained therein a capped or filled bottle, to avoid interference or meddling; provides a holder mountable upon the frame of a door or window, which may be released only by opening the door or window; provides a holder temporarily mounted beside a door or window which may be removed during the intervals between the delivery of the bottles containing the milk; and provides a holder to operate in conjunction with a door or window sill or other rest, which when locked is held in position by the adjacent door or window.

PROPELLER.—H. D. F. BAGLEY, care of E. Brimfield Hampden Co., Holland, Mass. This inventor provides a propeller having a maximum of efficiency in developing speed from a given power, and provides a form and arrangement of blades that will present a maximum of surface to the water at the hub and yet minimize the cavitation.

BANJO, DRUM, OR SIMILAR MUSICAL INSTRUMENT.—C. HABERMANN, care of Oscar Schmidt, 87 Ferry St., Jersey City, N. J. This invention provides improvements in banjos, drums, or similar musical instruments, whereby a sharp, clear and melodious tone is produced, and the construction of the means for drawing and holding the tightening ring in place is simplified and a finer appearance is given to the instrument.

BOTTLE CLOSURE.—H. V. PICK, care of Bernard Noonan, 835 Columbus Ave., N. Y., N. Y. This bottle closure is especially adapted for use with the form of bottles having a long neck as a handle portion. It is also adapted to snugly fit about the mouth of the bottle, so as to prevent the entrance of dirt, dust or any foreign material to the liquid in the bottle.

DEVICE FOR APPLYING SUBSTANCES TO TREES, SHRUBS AND VINES.—W. R. KLECKNER, Cowell, Cal. By means of this device an insecticide or other substance may be so applied to a tree, shrub, or vine, as to enable the sap to readily take up such substance. It will prevent injury to the growths named, and will prevent leakage and waste of the substance to be applied thereto.

Heating and Lighting.

PIPE SUPPORT.—W. B. GRAY, 1327 South 22nd St., Louisville, Ky. This is an improvement in traveling supports for pipes, and the aim is to provide a safe and simple device for supporting heating and power pipes, wherein means is provided for permitting the expansion and contraction of the pipes without injury to the pipe or to the support. Mr. Gray has invented another device for supporting heating and power pipes, wherein means is provided for permitting the expansion and contraction of the pipes without injury to the said pipes or to the support.

FILAMENT LAMP.—M. SIDON, 616 W. 182nd St., New York, N. Y. This invention relates generally to filament lamps and more particularly it involves a lamp of this type in which the bulb is made of a plurality of parts adapted to fit closely together whereby the proper vacuum within the bulb may be secured.

AUTOMATIC FURNACE DAMPER.—A. W. ARNOLD, Goshen, Ind. This improvement relates to dampers or draft governors which are designed to operate automatically under the influence of the draft itself to maintain a substantially uniform combustion of fuel, in accordance with the conditions for which the devices may be adjusted.

VALVE FOR GAS BURNERS.—E. S. ALLEN, 517 W. 134th St., New York, N. Y. The more particular purpose of the inventor is to produce an article having a number of its movable parts located within a sleeve forming a part of the burner and rendered detachable for the purpose of facilitating the removal and replacement of said movable parts.

Household Utilities.

FLY PAPER HOLDER.—J. R. SMITH, Stella, Mo. This invention relates to insecticides, and has particular reference to a means for holding ordinary sticky fly paper to prevent the same from being exposed in an unsightly and unsanitary manner, and at the same time will be held from being blown about by puffs of wind or the like.

CURTAIN FIXTURE.—H. REUBEL, 107 E. 17th St., Manhattan, N. Y., N. Y. This fixture is arranged to permit of conveniently placing the curtain rod in position on the supporting brackets to securely hold the curtain rod in place on the brackets, and to allow of placing the fixture directly under an overhanging or projecting molding or the like.

Machines and Mechanical Devices.

TICKET DEPOSIT BOX.—J. ANDERSON, 408 Grand View Ave., Ridgewood, N. Y. This invention provides means for canceling, exhibiting and depositing tickets mechanically and outside of the control of the attendant; provides for preventing the extracting of tickets from the deposit box after being placed therein; and provides a mechanism for operating the canceling and depositing devices which is simple, efficient and durable in construction.

CONTROL OF BRUSHES.—M. VANDAL, 8 Rue St. Augustin, Paris, France. The invention pertains to improvements in control of brushes whereby to communicate to two sets of brushes, having each one or more brushes, both a reciprocating and a circular motion in the brushing plane. The combination of these motions is for the purpose of distributing any material, such as color for instance, equally on any surface plane or substantially so.

EXPANSION LIFT.—M. L. SENDERLING, 333 Fairmont Ave., Jersey City, N. J. This inventor provides a mechanism having a pivoted base to permit a lateral swing of said mechanism thereon; provides a thrust member for said mechanism, pivotally mounted thereon to rock in a plane perpendicular to the plane of rotation of said base; and provides a mechanism having terminal thrust members and a flexible expansion member to separate the thrust members, and pivotally connected with these members to permit disposition thereof in angularly disposed planes.

SAFETY GEARING FOR DRILLS.—J. O. FOSTER, Peculiar, Mo. It is sought in this invention to provide cushioning mechanism interposed between relating movable parts of the winding mechanism, and so arranged that when the drill is dropped, the shock upon the gearing is cushioned and the consequent damages to the gearing are reduced to a minimum.

Prime Movers and Their Accessories.

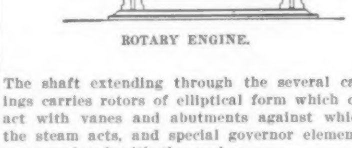
JOINTING APPARATUS FOR BOILER TUBES.—S. A. DUGAN, Gorgona Empire, Canal Zone, Panama. The device covered by this patent is for joining the tubes of steam boilers to the tube sheets. The inventor produces an annular depression in the sheet to receive the tube, and he employs for the purpose a hollow shaft having radially movable cutters, which are gradually expanded by a tapered spindle, the spindle shank being threaded and receiving a nut fitting in a recess in the shaft.

INTERNAL COMBUSTION ENGINE.—F. D. CALKINS and A. C. JOHNSON, Sunnyvale, Cal. The invention has for its purpose to provide means for controlling the admission and exhaust of the motive fluid, wherein a continuously rotating valve having a large bearing surface is provided separated from the explosion chamber of the engine by a water jacket, and arranged to automatically compensate for wear. The inventors have patented another internal combustion engine which provides on an engine a rotating valve having a large wearing surface and separated from the explosion chamber in order to prevent heating and deposits of carbon, and wherein means is provided for automatically compensating for the wear on the valve.

Prime Movers and Their Accessories.

ROTARY PUMP.—A. F. FORD, 1165 Pine St., Walla Walla, Wash. This invention has reference to improvements in rotary pumps, and has for an object the provision of an improved structure in which the pumping apparatus may be arranged to operate as a horizontal pump or a vertical pump.

ROTARY ENGINE.—G. E. CALLAWAY, Jonesboro, La. Address J. M. Beadley, secretary. This engine provides a series of casings successively increasing in diameter, and the steam is used expansively in each casing in succession.



ROTARY ENGINE.

The shaft extending through the several casings carries rotors of elliptical form which coact with vanes and abutments against which the steam acts, and special governor elements are associated with the engine.

Railways and Their Accessories.

LOCOMOTIVE AXLE BEARING.—W. C. STEPHENSON, Rocky Mount, N. C. Journal blocks or bearings of locomotives are commonly inserted from below in slots provided in the frame and secured by wedges called "wedge-bolts." When the last break or require removal or replacement, it is necessary to first remove the horizontal bar, or so-called "binder," by which the wedge-bolt is supported. The object here is to provide an improvement whereby the removal of the wedge-bolt can be very easily and quickly effected.

Pertaining to Recreation.

PIN SETTER FOR BOWLING ALLEYS.—E. SCHLOSSBERG, 1007 Metropolitan Ave., Brooklyn, N. Y. The invention refers more particularly to means for centering the tenpins, which means comprise a plate or platform provided with openings for the pins and means for actuating the plate. The pin setter indicates to the players that the pins are set in the proper places.

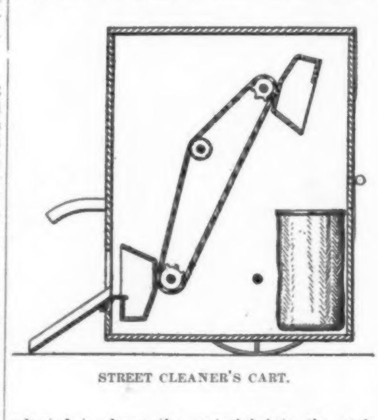
Pertaining to Vehicles.

HORSE DETACHER.—R. R. MORGAN and W. H. CORDER, North Carrollton, Miss. An object of this invention is to provide means whereby a horse which is harnessed to a vehicle may be liberated therefrom, said means consisting in a device for detaching the traces, the hold-back, and the bellyband, thus permitting the horse to emerge from between the shafts clear of the vehicle.

SIGN AND INDICATOR.—P. FICCIO, care of V. Ficcio, 1015 Franklin St., Tampa, Fla. This invention pertains to means for illuminating signs and indicators, especially those carried at the rear of automobiles. The main object is to provide a lamp having novel means for throwing the rays of light upon the registration number.

BUMPER FOR LOG WAGONS.—W. F. JONES, Dialville, Tex. The improvement has reference more particularly to a device mounted to roll on a wagon bolster and adapted to collapse below the carrying surface of the bolster. This inexpensive, simple and easily operated bumper will prevent transverse and longitudinal displacement of a load of logs when in operative position.

STREET CLEANER'S CART.—T. B. MASON, 209 So. Warren St., Trenton, N. J. In this patent use is made of a cart body having means to detachably hold a bag or sack, and an endless chain is mounted within the closed body of the cart and carries receiving buckets



STREET CLEANER'S CART.

adapted to dump the material into the sack, there being a novel pan and appurtenances at an opening provided in the body at the side opposite the sack whereby the street cleaner may sweep the material in the street into a carrier bucket presented at the opening. Means are provided to lock the chain with an empty bucket disposed at the receiving opening.

DEMOUNTABLE RIM.—L. A. GORDON, 165 Barclay St., Fall River, Mass. The rim is especially for use in wheels having pneumatic tires, for permitting the rim which directly supports the tire to be demounted from the wheel, in order to facilitate the removal of the tire from engagement with the rim. Means are provided whereby the rim may be mounted on wheels having ordinary rims of the clincher or quickly separable type, without requiring changes in the rim itself.

Pertaining to Vehicles.

AUTOMOBILE VEIL.—M. SALTZ, 20 W. 22nd St., New York, N. Y. This veil is designed especially for ladies' use, and the object of the invention is to provide a veil designed more especially for use when automobiling or the like, to protect the wearer from excessive air currents and dust, thus permitting the taking of a trip with increased comfort and enjoyment.

HARNESS ATTACHMENT FOR SECURING NETS AND BLANKETS.—F. H. MCCORMICK, 19 Charles St., Hillsdale, Mich. The device comprises a bucklelike frame, a prong or tongue pivoted thereto, and a spring for holding said prong in either of two positions, to wit, folded as when engaged with net or blanket, or extended laterally as when serving as a rein-guard.

AUTOMOBILE JACK.—J. DE H. BUNN. Address Dr. Philip R. Koons, 58 West Main St., Mechanicsburg, Pa. The purpose here is to provide a device by means of which an automobile or like vehicle may be lifted clear of the ground or other supporting surface and held in such position as long as necessary, and wherein the device is capable of adjustment for different heights.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes for Inventors

Housing the Bed in the Ceiling.—Theodore H. Sorlein, Granite Falls, Minn., has secured a patent, No. 1,069,585, for a bed which when not in use can be moved up into an opening or recess in the ceiling and then a false ceiling plate can be moved to obscure the bed from view. The English novelist H. G. Wells some years ago suggested that bed-making could be simplified by hoisting the bedclothes on strings between ceiling and floor and by dropping them into position again when bedtime comes.

Three Patents Relating to Steel Production.—James Churchward of Mt. Vernon, N. Y., has secured three patents, one, No. 1,069,318, being for an optical pyrometer adapted to be used in measuring of glowing bodies and by which the temperature may be measured by direct observation of the glowing body, by passing the rays through a medium having an adjustable opacity and thereby eliminating all rays except those representing a certain shade whereby the temperature may be determined. A second patent, No. 1,069,387, relates to a steel process and an article, the process seeming to produce a fibrous structure in steel and compositions of steel. The third patent, No. 1,069,601, provides a rotatable furnace of special construction described as fitted to secure homogeneity in molten material and especially metallic mixtures.

A Number of Peter Cooper Hewitt Patents.—Peter Cooper Hewitt of New York, assignor to Cooper Hewitt Electric Company of Hoboken, has secured patents No. 1,064,685 for electric lighting apparatus, No. 1,064,686 for gas or vapor electric apparatus, No. 1,064,687 and No. 1,064,689 for vapor electric devices, No. 1,064,688 for electric lighting apparatus, No. 1,064,690 for automatic starting device for vapor lamps, and No. 1,064,691 for system of electrical distribution.

United States Patents to Foreigners.—hen we stop and consider the large number of patents of the United States issued to esidents of foreign countries, we are surprised, and gratified that foreign residents appreciate the benefits and take advantage of the opportunity to secure patent protection in this country to such great extent. In a recent weekly issue of patents the total number of patents issued to residents of the United States was 442 while 95 patents were issued to residents of foreign countries, or more than twenty per cent of the number issued to residents.

Maturing Immature Cotton Bolls.—John Ellwood Lee of Conshohocken, Pa., assignor to John B. Hall of Philadelphia, has patented, No. 1,073,914, an apparatus for maturing immature, unopened or frost bitten cotton bolls, in which a moisture extracting chamber has an endless apron to receive the bolls and means for ejecting steam upon the bolls and for regulating the temperature of the moisture extracting chamber.

A High Combustible for Explosive Engines.—In a patent, No. 1,073,233, to Rudolf Hense, Charlottenburg, Germany, there is presented a process for obtaining a combustible of high value in which light hydrocarbons are added to heavy hydrocarbons and distilled at a high temperature and to the product caustic potash is mixed and the mixture settled. The settlement is then taken off and to the resulting mixture is added rosin substances as colophony and compounds of the nitro group as picric acid after which the mixture is settled, the liquid drawn off and purified and cleared by fractional distillation.

A Bookbinding and Covering Machine.—In patent No. 1,073,324 to Alfred Bredenberg of Champlain, N. Y., assignor of one half to the Sheridan Iron Works of New York and one-half to T. W. and C. B. Sheridan Co. of New York, is shown a bookbinding and covering machine having an endless carrier together with mechanisms for performing respectively upon the book carried by the carrier various operations involved in binding and covering with such mechanisms arranged in series, part along one stretch and part along another stretch of the carrier.

LEGAL NOTICES

INQUIRY COLUMN

READ THIS COLUMN CAREFULLY. You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry *may* be repeated.

MUNN & Co., INC.

Inquiry No. 9338. Wanted the name and address of patentees who desire to dispose of their patent rights in Silo Doors; also names of manufacturers of the same.

Inquiry No. 9339. Wanted names and addresses of purchasers of Uranium and Vanadium.

Inquiry No. 9340. Wanted the name and address of manufacturers of knock-down barrels, staves, hoops and heads which may readily be assembled.

Inquiry No. 9341. Wanted, mail order article. A man with long experience in the newspaper and advertising field desires to get in touch with the inventor or manufacturer of same quick-selling article, with the idea of inaugurating a Mail Order business to mutual profit.

Inquiry No. 9342. Wanted, a machine to cut No. 18 wire in 2½ inch lengths and sharpen both ends similar to tack points. One operation preferred.

Inquiry No. 9343. Wanted the name and address of manufacturers of machines for grinding the peel of oranges and grapefruit.

Inquiry No. 9344. Wanted name and address of manufacturers of patent articles of merit suitable for mail order distribution.

Inquiry No. 9345. Wanted name and address of manufacturers of Oxy-Acetylene Cutting and Welding Torch, also an easy opening can suitable for shoe polish.

Inquiry No. 9346. Wanted the name and address of parties manufacturing tobacco stripping machines, and other machines pertaining to cigar manufacturing and cigar banding machines.

Inquiry No. 9347. Wanted the name and address of an industrial school where shoemaking is taught in all its branches.

Inquiry No. 9348. Wanted the name and address of manufacturers having useful household necessities, with a view to obtaining exclusive territory for a house to house canvass.

Inquiry No. 9349. Wanted the names and addresses of the makers of machinery for making Malt Tonic, also a machine for making grease, and machines for applying plaster (Cement Gun).

Inquiry No. 9350. Wanted the name and address of the manufacturer of a printing press for the printing of tapes for clothing. The machine should preferably be worked by hand.

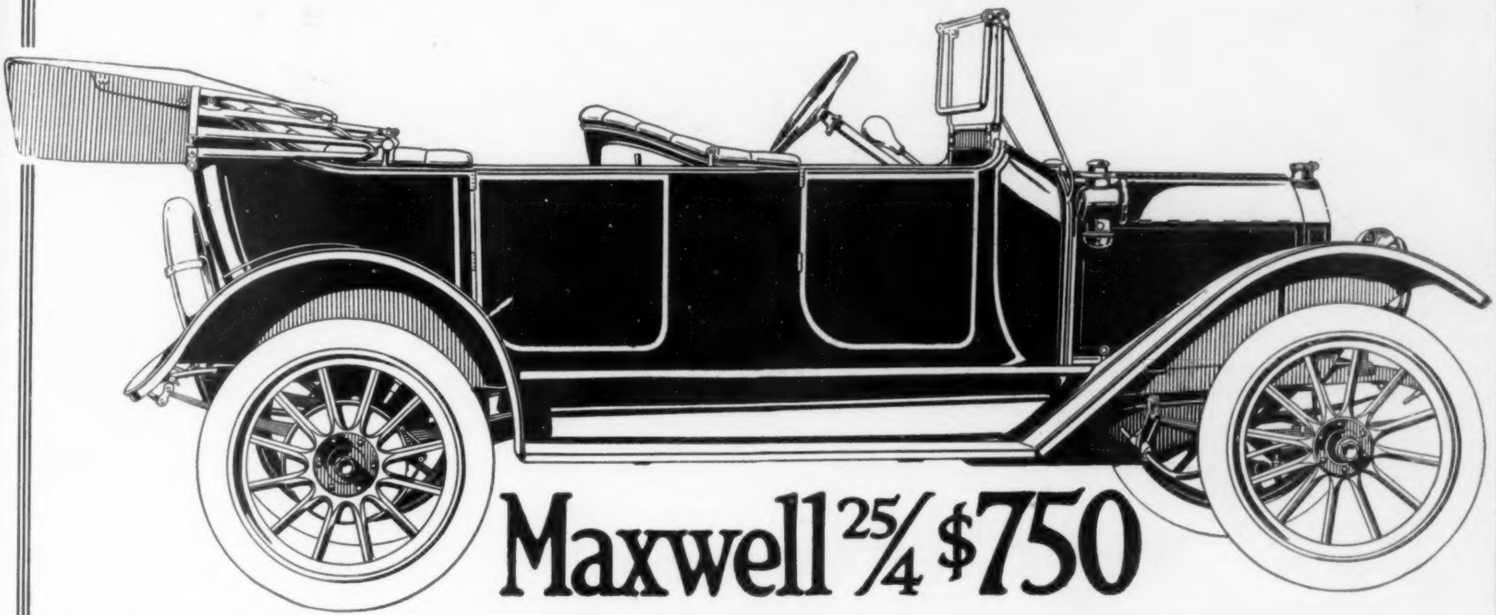
Inquiry No. 9351. Wanted to make some article out of wood which could be made from 2 inch ash, by party having 75,000 or more feet of waste per year which is now used for fuel.

Inquiry No. 9352. Wanted the name and address of a person who is in a position to get the state or county agency for articles of merit that can be sold to business houses or others at $3.00 or over. No kitchen utensils desired

Inquiry No. 9353. Wanted the name and address of a manufacturer who can make flexible oil cans.

Inquiry No. 9354. Wanted the name and address of a manufacturer of a machine which will stitch silk around small metal rings.

Inquiry No. 9355. Wanted the name and address of the maker of triplex glass.



Good Lubrication

(*Concluded from page 14.*)

not only necessary that the compression should be secured, but that it should be secured by proper means.

The troubles attendant upon poor compression in the cylinder are well known to most motorists. Under these conditions a motor is frequently unable to take a hill at all, and in any case the speeds must be changed in order to accomplish it. This is the case even where the same motor with good compression will not have the slightest difficulty in negotiating the same grade at top speed.

Good Adhesion Necessary in an Oil.

It is, therefore, evident that in order to maintain the good compression in the cylinder and at the same time avoid excessive wear and tear, due to metal to metal contact, it is necessary to have an oil which will adhere to the cylinder walls, filling the space between the piston rings and cylinder walls so that compression is secured and the metal surfaces are still kept apart. If the lubricating oil used is too light or is not of such a character as will provide this, the piston rings and the walls of the cylinder will come together so that there is excessive wear, resulting in a larger clearance at some points in the cylinder, in a difficulty in securing as much compression as ought to be secured, and in a much more rapid replacement of parts in order to maintain a working condition at all.

It is, of course, possible to run a motor for a certain length of time on any kind of lubricating oil, and it may be months before the difference in lubricating oil will begin to show itself. Unfortunately, however, when the difficulty becomes obvious the damage is practically all done.

In this connection it may be stated that, while the different motors have different systems of lubrication to some extent, and while these different systems may require slightly different grades of oil, this is not true of all oils or of all the modifications of the systems. Practically all systems of lubrication in use can be divided into three general classes and combinations of these classes. They are—splash, force feed, and circulation systems—and the difference in the oil required for these different conditions of lubricating systems is merely a difference in body, due to the mechanical limitations and not a difference in character. It is true that some of the oils on the market are so manufactured as to be suitable only for a limited number of conditions, and in such cases variations in motor and lubricating system design may require modifications in the character of the lubricant.

It is probable, however, that there are more grades of lubricating oil in use than the mechanical conditions would warrant, and the right character of oil is much more important than a specific grade.

Changing the Oil in the Crank Case.

For all systems of lubrication, and particularly with the splash system and the modifications thereof, it is very important to see that the lubricating oil in the crank case is changed a sufficient number of times, particularly if there is any leakage of the air mixture into the crank case during the compression stroke. It frequently happens that there is a slight leakage on each compression stroke sufficient to allow a certain amount of gasoline to get into the crank case, where it condenses in the lubricating oil, making the oil absolutely unfit for further use, and increasing the cylinder wear-and-tear out of all reason. Motors have frequently been run for 200 or 300 miles with lubricating oil in the crank case which was absolutely useless, as far as preventing wear-and-tear was concerned, and which performed its only service in carrying away some of the frictional heat so that there was no freezing of the engine.

In one case which came to the writer's notice, after the car had been standing for some time, a repair man opened the crank case, lighting a match in order to examine something inside the case, was surprised at an explosion sufficient to seriously burn his hands and face. This explosion was undoubtedly due to the presence of gaso-


GENERAL VEHICLE
GREATEST VALUE
GV

line in the lubricating oil in sufficient quantity and its evaporation into the surrounding atmosphere.

It is evident from a careful study of motor lubrication that the character of the lubricating oil and system not only have a direct bearing upon the wear and tear, but also upon the power developed and the consumption of the lubricating oil, and of these it is probable that the difference in power developed is alone sufficient to more than pay for any difference there may be in oil cost. It is, of course, obviously impossible for any man in the ordinary running of his car to test as thoroughly as advisable the effect of a lubricating oil. It is true that the effect of the oil in practical work on the road is the important effect, and if the motorist is given to careful and accurate recording, he can by cleaning his machine thoroughly, by putting in an exact quantity of oil, by running over a specified course, using a certain speed or gear change on the hills, seeing that the atmospheric conditions are as nearly as possible alike, and using the same gasoline in both cases, determine the effect of his lubricating oil closely and accurately. If he keeps his accounts fairly well and understands how much it costs for repairs and replacement to his car, he can determine without such testing whether there is any difference in the use of one oil over another, particularly in the replacements of spark plugs, regrinding of valves, and in the cleaning of cylinders, but in this case he obviously must cover a great deal longer time, and his decision will be correspondingly delayed.

As a matter of fact, the only feasible way for the motor owner to do in determining the value of different oils, is to confine his buying in the first place to one or other of the several well-known brands of oil which have, what the lawyer would term, *prima facia* evidence of their value and then by keeping an accurate account of the power developed, of the consumption of oil, of the deterioration of oil in his crank case, of the carbon deposited on valves and spark plugs, determine the oil which is best suited (from the results it gives) to his machine and after such careful determination stick to the material which has shown itself to be the most adaptable and the best.

The Importance of a Clean Lubricating System.

The oil, however, is not to blame for all the misfortunes that happen to his motor, nor is the owner absolved from his duties when he has bought an oil which he has every reason to believe is good for his machine. Some care is required in attending to the lubricating system so that the proper amount of oil, without dirt, is fed to the moving parts. In the splash system or in modifications of it, where the oil is carried from the crank case and returned without filtering, it is important that the crank case should be cleaned frequently, as the constant dipping of the connecting rods into the oil will keep any particles of grit, suspended through the liquid so that they are carried into the moving parts of the motor with a very speedy damage to such parts.

Furthermore, if the oil in passing through the system and back to the crank case tank is filtered, the filtering material should be removed and replaced frequently enough to insure its working at all times. The pipes which carry the oil to the various parts of the machine should be examined from time to time to see that they are clear and clean, and particularly in the winter time (unless the oil is of such a character that it will withstand practically any ordinary temperature without congealing), care should be taken that the pipes do not become clogged with congealed oil when the motor is standing.

The question of lubricant, or the transmissions and differentials, the magneto, etc., as well as grease for the axle bearings, etc., is of just as much importance as the lubrication for the motor itself. The difficulty of determining the effect of such lubricant is in this case, however, increased so that it is practically impossible for the motorist to determine as between a number of fairly good lubricants which are the best and most advantageous, and there is only one safe rule in this case, and that is, to buy the lubricant from the manufacturers who are supplying the motor owner with the most suitable cylinder lubricating oil.

Nothing gives less indication of its practical efficiency as lubricating oil. Color is not indicative, as two oils can be practically the same color and produce entirely different results from the standpoint of saving wear and tear, replacement and repair cost. Even the character of the crude has little bearing upon the value of the oil itself, and the only oil which is worth the motor owner's attention is the oil which proves in your machine that it will keep down the replacement of sparks plugs, regrinding of valves, cleaning of the cylinders, keep up the power, eliminate as far as possible deterioration in the crank case due to leakage from the cylinders. These are indications of its value which cannot be mistaken and which do not depend upon hypothetical determinations or tests the value of which the motor owner has no means of judging.

Adaptability of the Motor Truck

(Concluded from page 13.)

While the first of these, translated into its motor truck equivalent, is important, the second is absolutely vital, because here is where the big loss in operation most frequently takes place. Working a motor truck to its true capacity is a dark mystery yet to the average owner—and chiefly because he lacks the data on which to base his system.

Accurate recording instruments, giving mileage and periods of travel and idleness, are as vital to the truck as gasoline and oil if it is to be properly used.

The remaining principles, when they are applied to the truck, become a part of the second, in that they contribute to securing the maximum of productive activity.

The manufacturer must get materials promptly to the lathe and remove its product quickly. So must the motor truck be loaded and unloaded in the shortest possible time. And it will pay in the long run to remodel shipping rooms and loading platforms, install conveyors or interchangeable or dumping bodies as required, or, if necessary, to increase the loading crews. Idle time at several dollars an hour will quickly eat up the worth of the improvements. It is paying executives to tour the country with their architects, to study loading conditions and to build to keep pace with the revolution caused by new transportation methods.

As in the case of all other productive machinery, the operator must be skillful. Bonus systems, schooling, accurate impersonal and impartial supervisions, and high wages to good men will pay dividends in the delivery department. An expert repair man, or, failing that, a driver who has an incentive to show an efficiency record and the means of showing his efficiency conclusively by reason of the accuracy of the owner's knowledge of the truck's work, can save his salary many times over by a daily inspection and tuning up. Reckless maintenance promises of the salesmen have made the buyer indifferent to his own responsibilities. The lathe is not expected to be abused and repaired by the maker; neither should the motor truck.

To establish such ideals of efficiency as these calls for co-operation, education, and a revision of standards on the part of everyone connected with the problem. When the size of the industry is considered, it is clear that the successful solution will affect the well-being of the entire community by lessening the increasing cost of the distribution of commodities.

Wright Automatic Stabilizer for Aeroplanes

(Concluded from page 17.)

izing plane, but a series of small ones, strung out over the whole lateral extent of the aeroplane. It is a defect of design in the device shown that the moving parts are too self-supporting, so that they are heavy and inert, whereas they could every-

where be supported on stationary parts, and then be broken up into a multiplicity of small units of far less total inertia and proportionally greater strength. Restrained by the "stops" at 9, the plane 5 must be made almost impractically heavy, so as not to be warped out of shape or broken by the wind. A great number of smaller planes would also make the average air pressure on the stabilizer almost identical with that on the main aeroplanes and do away with the difficulty previously pointed out. The many small "parallel motion" frames would then have to pivot on a common shaft.

It remains still to be pointed out that the front elevator shown is less suited to automatic control than the rear horizontal rudder which will doubtless be actually used. If the front rudder is swung suddenly, it may easily get the machine into a situation where its reversal produces no further effect. It will quickly turn it around its transverse axis, with the weight concentrated along that line, but the relative wind will not change accordingly. The machine will "coast," first moving on in the old direction because of its momentum. This will increase the effect of a front elevator; the machine will "buck" so violently, that the reversed rudder will become merely parallel to the relative wind, and a tail slide will be inevitable.

If there is a minimum of "internal work of the wind," the device shown may work well and, safeguarded by the hand control 10, prove a labor-saving device like the pendulum. By an ingenious arrangement the parallel motion may be so adjusted during flight by pushing out or pulling in the handle 11 (held in place by friction) that the plane 5 will then keep the main planes at an ascending or descending angle of attack and thus stabilize a long *vol plané* or a climb just as well as horizontal flight.

During a recent visit of Mr. Orville Wright to New York, it developed that the actual stabilizer used exhibits essential differences from the patented device, although it may be said to work by the same principle. It was revealed that electrical contacts play a part in transmitting impulses which would be greatly in favor of a graded effect, that an entirely novel correcting device counteracts inherent deficiencies of pendulum control, and that the horizontal rudder is indeed in the rear; also, especially, that the weights are now in every direction concentrated as much as feasible at one point, to guard against inertia and momentum effects. Thus modified the apparatus is stated to have worked successfully in long daily flights even in winds of from twenty to twenty-five miles an hour. Changes merely in the angle of the relative wind may apparently be coped with by stabilizers of the Moreau or the perfected Wright type. The fact that the automatic mechanism has proved serviceable in winds of twenty to twenty-five miles an hour, is not astonishing if the wind was uniform or if such variations as were manifest were confined to a change in direction only. The difficulties to be most feared are those which accompany violent changes in the strength of the wind. It also was found necessary to cut out the automatic control in landing.

Mr. Wright is certainly better equipped in every way to develop such a difficult mechanism than most others, and if it should work half as well under critical conditions, as it is said to under normal conditions, its publication on the tenth anniversary may prove to be fully as important as the first announcement of the aeroplane itself. It was stated that barely a touch of a lever for steering was all that was needed.

A Record Balloon Voyage

A DISPATCH from Perm, on the border between European and Asiatic Russia, announced the arrival on December 21st of a German balloon which made the flight of 1,740 miles from Bitterfeld, Prussian Saxony, without a stop in eighty-seven hours. This beats the record of the French aeronaut, Blenaime, who made a flight of 1,491 miles.

NEW BOOKS, ETC.

QUESTIONS AND ANSWERS ON AUTOMOBILE DESIGN, CONSTRUCTION AND REPAIR. By Victor M. Pagé, M.E. New York: Munn & Co., Inc. 5¼ by 7½ inches; 622 pp.; 329 illustrations; cloth. Price, $1.50 postpaid.

We can name no writer better qualified to prepare a book of instructions on automobiles than Mr. Victor W. Pagé. His experience for years as technical editor of a motor-car journal taught him what the public wished to know, while his training as instructor in automobile schools showed him how to impart this information to others in simple language. His previous works, "The Modern Gasoline Automobile" and the "Trouble Chart," by which the location of gasoline engine troubles was made easy, are widely known among automobilists. Soon after their publication many letters were received asking the author to prepare a more elementary work which could be sold at a lower price. The present work is an answer to these petitions. It is written in the form of a catechism, beginning with the very rudiments of automobile engineering, and presupposing no previous technical knowledge on the subject. Not only pleasure vehicles, but commercial vehicles, as well, are included in the work. Special care is taken with the logical arrangement of the various topics. There are about two thousand questions and answers which take up in a practical way every detail of the machine with which the owner is liable to be concerned. It is written for that vast army of motorists who cannot afford to hire a chauffeur and must take care of their own machines. It is written, as well, for the man who can afford to pay for the care of his motor car but is not willing to be imposed upon by a dishonest chauffeur working in collusion with unscrupulous repair-men. The book is copiously illustrated with drawings and photographs, showing the latest domestic and foreign practice.

AMERICAN TELEGRAPH PRACTICE. A Complete Technical Course in Modern Telegraphy, including Simultaneous Telegraphy and Telephony. By Donald McNicol, A.M., A.I.E.E. New York: McGraw-Hill Book Company, 1913. 8vo.; 507 pp.; illustrated. Price, $4 net.

American systems are handling a hundred telegrams to-day where ten years ago they could take care of but fifty, and the time of transmission between distant points has been cut in half. The work in hand conveys a clear idea of the way in which this development has been brought about. Existing systems and modern methods of operation are described, and the mathematical formulæ are so worked out as to be readily mastered by all who understand arithmetic and elementary algebra.

THE NATURAL HISTORY OF THE TORONTO REGION. Ontario, Canada. Edited by J. H. Faull, B. A., Ph.D., Associate Professor of Botany, University of Toronto. Toronto: The Canadian Institute, 1913. 8vo.; 419 pp.; with maps and illustrations. Price, $2.

The articles comprising this work are the authoritative utterences of specialists, and well worth the study of any who may have an interest in the natural history of the city and its vicinity. History, geology, and climate are touched upon, and the flora and fauna are described in a series of papers that present their respective subjects in a well-arranged and accurate manner. The work is rich in maps, no less than three being carried in a back pocket of the book, while others appear as folding inserts or full-page charts. These graphically present such subjects as the life zones of eastern North America, a road map of Toronto and environs, and maps of neighboring countries.

THE HEART OF GASPÉ. Sketches in the Gulf of St. Lawrence. By John Mason Clarke. New York: The Macmillan Company, 1913. 8vo.; 292 pp.; illustrated Price, $2 net.

Gaspé, whether regarded as a county or a peninsula, is the northeastern outpost of Quebec. It is larger than Massachusetts, its wild coasts sparingly dotted with villages, whose settings, modes and customs are survivals of remote ages. The author characterizes the inhabitants as invariably kind and hospitable, wresting their scanty livings from reluctant soil and sea. His pen-pictures of their rough yet fascinating country are enhanced by glimpses of history and information regarding its place names. Many illustrations of natural scenery, native architecture, and seabirds and their haunts enliven the pages of a narrative that, without any attempt at fine writing, yet conveys with a simple fidelity the rugged charms of a territory whose features will be new to many readers.

ON HEROES, HERO-WORSHIP, AND THE HEROIC IN HISTORY. By Thomas Carlyle. Edited, with Introduction, Notes, and Bibliography, by Herbert S. Murch, Ph.D., Instructor in English in Princeton University. New York: D. C. Heath & Co., 1913. 12mo.; 313 pp.

This new edition of Carlyle's inspiring and illuminating work has been prepared by Prof. Murch with particular care toward the needs and limitations of those just entering upon the study of Carlyle. The biographical introduction is immediately followed by a discussion of the style, plan, and teachings of the work, in which certain difficulties are explained away, and the student is enabled to approach the lectures in an understanding manner. The profuse notes are a further aid toward clarifying the text to the beginner's mind, and a bibliography for supplementary reading will prove to be an appreciated feature.

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12888) C. S. is informed that no inquiries are answered unless the full name and address is given. We do not make any broad statements as to who make "best" revolvers, etc. The concern you mention by name makes a reliable article.

(12889) C. U. asks: Kindly tell me what is the scientific reason for the effect which oil has when poured on tempestuous waves. A. The spreading of oil over the surface of water is due to the fact that the surface tension of the oil is less than that of water. The water draws the oil over its surface by reason of its greater surface tension. The oil on the other hand has a very great viscosity, and the film of oil on the water holds the surface of the water from breaking into ripples. The waves therefore become smooth, and although they are still very high, they roll smoothly by and do not break over the vessel. The vessel rises easily and rides over the waves, which without the oil broke over the vessel.

(12890) J. W. McC. asks: I am anxious to get in touch with some schools that have divided or rather segregated the boys and girls in the physics work. We are doing the work on this line this year, but have not been able to find a suitable text for the girls. This is what I am after. Any information will be appreciated. A. We do not know any schools in which the girls are taught physics in classes separated from the boys. Physics is usually taught as a branch of mathematics in high schools and most colleges, and the subject is divested of most of its interest for young people for this reason. A text book based upon the experiment and not upon the formula is much to be desired. One appeared this year which is very attractively gotten up, by Millikan and Gale, which we send for $1.40 postpaid. It is called "A First Course in Physics," and is almost wholly descriptive. No similar college text book has appeared.

(12891) J. W. B. asks: As I have not missed a number of the SCIENTIFIC AMERICAN in forty years, I now for the first time ask a favor. I want to know what material is the best insulator to fill a 1½-inch space between the inner and outer side of an ice box. Sawdus is not much good, and air space cannot be perfectly confined. A. Charcoal has been used more than anything else in filling the walls of refrigerators, though wool should be just as good. Anything which will prevent currents of air will answer the purpose; one thing is about as good as another. Sawdust will do this, and it is not a conductor of heat. There is nothing which will act absolutely to prevent the passage of heat. A vacuum is the very best insulator against the passage of heat, but this is not practicable in an ordinary refrigerator.

(12892) D. L. P. asks: Please tell me how to make an amalgam with silver and m rcury. A. In the preparation of silver amalgam, pure silver must be used. If the silver is in the powdered form, the amalgamation is more easily brought about. The silver powder can be prepared from a solution of nitrate of silver, one part in 10 to 15 parts of water. Put this solution into a bottle and shake it with a few small pieces of sheet zinc. The silver will be precipitated in a few minutes. When the powder has been washed and dried it is ready for use. The silver can be dissolved directly in the mercury, but a quicker method is to heat the mercury nearly to its boiling point in a crucible, and add the powdered silver, stirring meanwhile vigorously with an iron rod. Silver amalgam can be prepared in the cold by making a solution of nitrate of silver, 1 part of nitrate by weight to 3 parts of distilled water and adding 4 parts of mercury to this solution. The combination will take place by shaking the mixture. This process is taken from the "Scientific American Cyclopedia of Formulas," price $5, which contains nine pages upon the formation and uses of amalgams.

(12893) L. G. B. asks: I find plenty of information in the Encyclopædia Britannica and elsewhere on the dynamics of real gases with elastic molecules. How would the inelastic and frictionless particles of a hypothetical gas consisting of such particles behave? What directions would they take after collisions? Please refer me to literature discussing this. A. A frictionless, inelastic particle could not take any direction after collision with another similar particle. It could not rebound at all. It would lose all its momentum on collision and there would be no restitution for a rebound, since it is inelastic. We have no references to any literature of this subject. Balls of lead are sufficiently inelastic to illustrate this. They do not rebound from each other after collision, as in the familiar experiment in physics.

(12894) C. A. H. asks: A small tube closed at one end and filled with water will retain the water when held perpendicular with the open end down. This is due to atmospheric pressure. A claims that the same thing would happen in a pipe or tube of any larger dimension if the tube was held absolutely still. B claims that the water would fall if the diameter of the tube were larger. Which is correct—A or B? If B is correct, would like to know how large the diameter of the tube would have to be before atmospheric pressure would cease to retain the water therein. A. The tube closed at one end, filled with water and inverted, will retain the water if the diameter of the tube is small enough to be called capillary. If larger than this, the water will run out. The surface tension of water has a large part in the support of the water in the tube. We cannot give the diameter of the largest tube which will support water in this manner, but we have seen it done with tubes as large as a tenth of an inch.

(12895) O. O. F. asks: Please insert an answer to the following questions in the Notes and Queries section of the SCIENTIFIC AMERICAN. 1. What is the difference in feet between low tide and high tide on the ocean or on the Atlantic coast generally? A. On the open ocean the difference of level between high and low water of the tides is 2 or 3 feet. On the Atlantic coast it varies from 2 to 3 feet up to 50 to 60 feet. 2. How far into Delaware Bay, Chesapeake Bay, and Long Island Sound does the tide reach with the same difference between low and high tide as on the ocean? What is the depth of these inlets at the mouth? Where can I buy a book containing similar information of any part of the world? A. We have not this information, and do not know where it can be obtained in any single book. The various books of sailing directions which navigators have for their voyages will give it for the different ports which they cover. The United States charts of the coast will give the depth of water at all parts of the coast. These books and charts can be purchased from dealers in nautical instruments. We would add that a high tide flows into Long Island Sound through New York Bay, and meets a low tide which enters the Sound from the east near Hell Gate, thus making the rough water and dangerous currents of that narrow passage and causing less rise and fall than if a single tide was in the Sound. Six hours later the tides are reversed, with the same result. The same action takes place in many parts of the world around a large island. 3. Does a propeller, similar to those used on aeroplanes, with a given power, have as much pulling force as a vehicle with the same power applied to the wheels? If not, how much less? If air were forced out from the rear of a vehicle with great force, would the propelling force equal that of a propeller with the same power? If the air were drawn in from the front, with great rapidity, leaving a partial vacuum, would the propelling force equal that of a propeller? A. A propeller working against a very mobile fluid like air does not have the same propelling force on a vehicle as when the same power is applied to the solid earth by the wheels. Jet propulsion has been tried in water with no valuable results excepting the gaining of experience and, as Mr. Edison once said about some unsuccessful experiments, "learning what cannot be done." It does not seem to be possible to get the same power from a jet as from a propeller. A vessel was built in recent years for jet propulsion, with no success.

(12896) W. S. E. asks: Please tell me through your columns why you can cut glass under water with a scissors. A. We have not been able to cut glass under water with shears in such a way that both pieces can be used. We can chip off the edges of a piece of glass under water. The pieces cannot fly in the water as they do when one cuts them in the air, but the crack often extends in a direction different from the one in which you wish it to go, and the piece is spoiled. We should say that glass cannot be cut with any precision under water with a pair of shears. The water seems to assist the shears in biting on the edge of the piece of glass, and to hold the pieces from flying about.

(12897) E. P. V. asks: A asserts that the earth moves faster at the equator than at any other place. B asserts that as the earth rotates as a whole, no one portion of it can move more swiftly than any other portion. A asserts that the angular velocity is the same but that the linear velocity is greater at the equator than at any other point. As you are doubtless familiar with the general trend of such discussions, the pros and cons of this particular one will not be repeated. Which is right? A. The earth rotates with the same angular velocity in all latitudes. The relative linear velocity is therefore the same as the lengths of the degrees of longitude. The degree of longitude at the equator is 69.16 statute miles in length. At your place it is 58.05 miles, in New York it is about 52.25 miles, and at the pole the degree has no length. So while the earth's surface moves 69 miles at the equator, it moves 58 miles at your place and 52 miles at New York. If you will take an orange or a lemon and turn it in your hand as the earth turns on its axis, you will doubtless see why this is the result in the earth.

(12898) W. H. S. asks: I shall be obliged to you if you will please give me the fusing temperatures (melting points) of the following metals: Platinum, iridium, gold, silver, copper, zinc, tin, lead, iron. A. We give you the melting points of the metals which you name in your inquiry, as given in the Bulletin of the Bureau of Standards No. 35, published by the United States Government, Washington, D. C. Platinum, 3,191 deg. Fahr.; iridium, 4,170 deg. Fahr.; gold, 1,945.5 deg. Fahr.; silver, 1,761 deg. Fahr.; copper, 1,981.5 deg. Fahr.; zinc, 786.9 deg. Fahr.; tin, 449.4 deg. Fahr.; lead, 621.1 deg. Fahr.; iron, 2,768 deg. Fahr.

Chalmers—1914

The New "Six"

$2175

Fully Equipped—f. o. b. Detroit

In Record Time the Master "Six" Has Sold Itself to the Nation

Public opinion has endorsed our own belief in the new Chalmers "Six."

Record Sales prove the new "Six" the most popular of all Chalmers cars. East, West, North and South this Master car has leaped to instant favor.

We began shipping 1914 cars the last of August. In September we received twice as many orders as we could fill. In October we shipped 1,111 cars — the biggest single month's sales in the history of the Chalmers Company. In November we had more orders on our books for the New "Six" than for any other model we ever built. In December, instead of slowing down for the winter, the big Chalmers factory was kept running full force. The country over, Chalmers dealers have been unable to fill *all* their orders.

This phenomenal sales record is simply the result of unusual value in the Master "Six."

For the 1914 Chalmers "Six" sells itself.

We have made strong claims for the new "Six"—claims that have caused a sensation in the motor world.

Yet every claim has been proved.

The Chalmers Standard Road Test reveals the Master "Six" through a course of sprouts which can neither hide its defects nor exaggerate its virtues — a trial such as not one owner in a thousand would give his car.

This is the plan by which the Master "Six" has sold itself to the Nation.

Here are extracts from a few of the scores of letters we have received from owners of the Master "Six." Read how this great new car is making good wherever motor cars are used. And please feel free to write any Chalmers owner. We rest our case for the new "Six" with the opinions of the people to whom it has sold itself.

Read What These Owners Say About the Master "Six"

Price Doesn't Indicate Real Value

I did not believe there was a car built at anything like the price that would do what this wonderful "Six" does. All I can say is that everything you claimed for it has been fulfilled in performance—and then some.

It climbs such hills on high as I never believed a car could mount. The motor is practically noiseless. The new one-motion electric starter can be described by only one word, "perfect."

You have brought into my life a factor of enjoyment for which the money I have paid for it does not begin to compensate.

W. L. HARRIS, President
New England Furniture & Carpet Co., Minneapolis, Minn.

Chalmers-Entz Starter Works Perfectly

I wish to express my pleasure and satisfaction in the new 1914 Chalmers "Six" which you recently sold me. I have tried this car out very thoroughly; have been away on several long trips, over bad roads, and have yet to find a cause for complaint. I wish to state my appreciation of the perfect working of your new self-starter. Not once since I have had this car has my chauffeur had to leave his seat to crank up.

To sum up, it is a comfortable, luxurious, and in every way a satisfactory car.

BERNARD LOWENTHAL, President
Acme Lace & Embroidery Co., 100 Fifth Ave., New York.

Equals Highest Priced Car

The Chalmers Model 24 "Six" you delivered to me October 11 has been in use every day since without trouble.

I have driven several high priced cars, and consider the performance and looks of the new Chalmers as good as any car at four or five thousand dollars.

W. A. CHEATWOOD, 1511-1512 E. Main St., Richmond, Va.

Didn't Know He Had Tools

You may be interested in knowing how the Model 24 in which Mrs. Tucker and I left your factory Saturday evening last, has behaved. We encountered rain, mud and heavy sand all the way from Ypsilanti to Terre Haute, Ind., yet reached Mattoon, a distance of almost 500 miles, with no trouble at all. Never had any of the tools out. In fact, I did not know what tools there were. The starter never failed.

Mrs. Tucker drove the car a portion of the time with the greatest ease.

E. B. TUCKER, Secy., Daily Journal-Gazette, Mattoon, Ill.

Car Itself Better Than Our Claims

The 1914 Chalmers "Six" is, in my opinion, a better car than any other make on the market at the same price.

I bought your Model 24 without a demonstration as I was convinced it was the car I wanted and that it would ride smoothly and easily. I am more than pleased, as it has demonstrated itself beyond my expectations.

J. M. REYNOLDS, 300 Chestnut St., Philadelphia, Pa.

The Best Car for the Price

After driving my new Chalmers "Six" nearly 3,000 miles I am even more pleased than when I first received it. As you doubtless know, this mileage has been distributed over not only state highways but also country roads of all kinds through the Adirondacks and Berkshires.

Its hill climbing ability, flexibility and general quietness of operation are particularly commendable. The electric starter and lighting system operate perfectly.

I consider it the best car for the price on the market to-day.

W. M. DEMING, General Electric Co., Schenectady, N. Y.

New "Six" Motor is Ideal

The new "Six" is the most complete and best all-around designed car that has ever been produced and I am more than pleased with the whole appearance. The motor is ideal. The electric starter is a masterpiece. You have reduced everything to its simplest form.

GEO. B. POOLE, 70 Kilby St., Boston, Mass.

You cannot be sure of getting the best automobile value unless you examine carefully the merits of the Chalmers Master "Six" and make a careful comparison with other cars. We offer you the way to such examination and comparison—the Chalmers Standard Road Test. Any Chalmers dealer will be glad to give you this test at your own convenience. Catalog on request.

Chalmers Motor Company,
Detroit, Mich.

Prefers Master "Six" to Any Other

My six-cylinder Model 24 has given satisfaction far beyond my expectations.

The pleasure I have had with it is such that I would recommend it to any of my friends who are considering the purchase of an automobile at any price.

DAVIS PEARSON, 904 Walnut St., Philadelphia, Pa.

Needs Only One Transmission Speed

The new Chalmers "Six" is designed to meet the wishes of anyone who wants a good car of moderate price and low up-keep. Nearly all people have ideas as to what ought to be in a good machine. I believe that the new "Six" just about fills the bill.

A person who never owned an automobile or drove one, could throw the switch and start the "Six." The improved disc clutch makes it easier to make a good start than a bad one. Not a jerk to it. Some of the speeds seem unnecessary. I have started on any of them, but I suppose that when you are in the mud, sand or water they ought to be used. Its speed capacity is more than I care to monkey with.

F. H. ROBERTSON, Sec. & Treas.
Hartford Western Land Co., Wichita, Kans.

Every Claim Fulfilled

My beautiful Chalmers car is giving the very best of satisfaction and service. It is all that you represent it to be.

FRED. A. MAILANDER, Pres.
The Mailander Co., Waco, Texas

New "Six" Best Buy on the Market

In the thirty days since I received my Chalmers "Six" it has fulfilled every claim made for it. I have driven it over 1,000 miles; I have thoroughly enjoyed every mile of it.

One of the first trips taken was through very heavy roads, but that made no difference. It pulled through 35 miles, without my once shifting to a lower gear.

This car in my mind is the handsomest on our streets.

I conscientiously believe that you have in the new "Six" the best automobile "buy" on the market regardless of price. It looks as if your success this season depends merely upon being able to supply cars to fill your orders.

W. E. EGLE, Waterloo, Iowa.

Easy Riding; Strong Pulling

I surely appreciate the ease with which my Chalmers "Six" carries itself over the rough pavements of our city.

The engine is a marvel. Its pulling qualities are simply wonderful. Its ability to throttle down on high speed is something in which the prospective buyer should be more interested than that the machine can run 75 miles an hour on high. The steering gear makes it glide around corners as though it were automatically controlled.

ALFRED B. KOCH, The LaSalle & Koch Co., Toledo, Ohio.